INTERGRAPH®
Smart 3D

Space Management
User's Guide

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Contents

Preface

This document is a user's guide for the Space Management functionality of Intergraph Smart™ 3D and provides command reference information and procedural instructions.

Documentation Comments

For the latest support information for this product, comments or suggestions about this documentation, and documentation updates for supported software versions, please visit *Intergraph Smart Support* (*https://smartsupport.intergraph.com*).

What's New in Space Management

The following changes have been made to the Space Management task.

Version 2016 (11.0)

- Added numerous graphics to the documentation to help explain concepts.
- Added a new locate filter, **Construction Graphics**. For more information, see *Space Object Properties* (on page 92). (P2 CP:271166)
- Added the **Assign Design Parent** command to specify the design and space parents for compartments and volumes. For more information, see *Assign Design Parent to Compartments and Volumes* (on page 83). (P2 CP:278727)
- Added the **Query Service** command. For more information, see *Query Service Command* (on page 84). (P3 CP:285197)
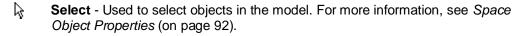
SECTION 1

Space Management

The **Space Managemen**t task creates and manages named space objects in your model. Using volumes, you can define safety zones, areas set aside for distinct processes, maintenance regions, or any other conceptual spaces that you need. The exact properties and specifications of these space objects are defined in the reference data, which also designates each volume type as an area, a zone, or an interference volume. A zone can refer to one or more space systems and areas, while an area can be entirely or partially part of several different zones.

There are several methods that you can use to define the geometry of a space object: by two points, by four points, by window, by selection, by plane and offset, or by reference to existing spaces. You can also create a volume in the model by defining a path and projecting a cross-section along it. In addition to these functions, you can merge existing spaces together.

The **Space Management** task has the following commands:

Select - Used to select objects in the model. For more information, see *Space Object Properties* (on page 92).

Create Space Folder - Creates a new hierarchical node for the organization of space objects. For more information, see *Create Space Folder* (on page 12).

Place Volume by Two Points - Defines a volume by selecting two points to represent opposite vertices of the volume that you need. For more information, see *Place Volume by Two Points* (on page 15).

Place Volume by Four Points - Defines a volume by three points to define a base plane and a fourth point to define elevation or depth. For more information, see *Place Volume by Four Points* (on page 21).

Place Volume by Window - Defines a volume based on the active graphical view of the model. The view boundaries, depth range, and possible clipping are used when generating the volume. For more information, see *Place Volume by Window* (on page 24).

Place Volume by Selection - Defines a rectangular volume that encloses a selected set of objects in the model. For more information, see *Place Volume by Selection* (on page 27).

Place Volumes by Plane and Offset - Defines rectangular volumes based on a reference plane and offsets from the plane. For more information, see *Place Volumes by Plane and Offset* (on page 29).

Place Volumes by Grids - Defines many volumes at once, based on a set of grid and elevation planes. For more information, see *Place Volumes by Grids* (on page 34).

Create Volume Bound by Spaces - Defines a volume by selecting sufficient

bounding spaces to create a closed volume. For more information, see *Create Volume Bound by Spaces* (on page 37).

Merge Volumes - Merges multiple existing volumes into a single new space. For more information, see *Merge Volumes* (on page 39).

Place Volume Along Path - Places a volume by specifying a cross-section and projecting the cross-section along a path. For more information, see *Place Volume Along Path* (on page 41).

Place Volume Using Primitive Shapes - Places a volume in the model by selecting a pre-defined volume shape from a palette and then providing dimensional information to define the shape size. For more information, see *Place Volume Using Primitive Shapes* (on page 53).

Associate Volume to Object - Establishes a relationship between an object and a space in the model. For more information, see *Associate Volume to Object* (on page 56).

Place Drawing Volume by View - Creates a clipping volume that is associated with a drawing volume component and a drawing view. For more information, see *Place Drawing Volume by View* (on page 58).

Place Drawing Volume by Selection - Generates a drawing volume around a selected set of objects in the model. For more information, see *Place Drawing Volume by Selection* (on page 60).

Place Drawing Volume by Two Points - Creates a clipping volume that is associated with a drawing volume component by selecting two points to represent opposite vertices of the volume that you need. For more information, see *Place Drawing Volume by Two Points* (on page 61).

Place Drawing Volume by Four Points - Creates a clipping volume that is associated with a drawing volume component by typing three points to define a base plane and a fourth point to define elevation or depth. For more information, see *Place Drawing Volume by Four Points* (on page 63).

Space Management Workflow

All space objects are placed in the model using information defined in the Space Management reference data. Using the reference data workbook, you can create custom space objects. Your first step is to review, edit, and otherwise customize the delivered Space Management reference data. For more information about customizing the reference data that is delivered with the Space Management task, refer to the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

After the reference data is customized to suit your needs, go to the Systems and Specifications task and define the systems that you want in your model. While you are not absolutely required to create your systems first, doing so keeps you from having to edit your space objects after placement to assign them to the correct system. With the systems defined, use the Grids task to define and place coordinate systems, elevation planes, and grid planes.

After the Space Management reference data and the needed systems, grids, and planes are defined, you can begin creating space objects for your model.

In This Section

Space Management Common Tasks

The following tasks are used frequently in the **Space Management** task.

Customize Reference Data

Create new space object types by editing the **SpaceManagement.xls** workbook. For more information, see the *Space Management Reference Data Guide* available from the **Help > Printable Guides** command.

Create Space Objects

Create space objects in the model. There are several methods of creating volumes in the **Space Managemen**t task. For more information, see *Create Space Objects* (on page 14).

Modify Space objects

Create new volumes out of existing ones. For more information, see *Create Volume Bound by Spaces* (on page 37) or *Merge Volumes* (on page 39). Additionally, you can modify any of the volumes that you place in your model. For more information, see *Modify Space Objects* (on page 65).

Define Relationships

Associate an object with a space in the model. For more information, see *Create a Relationship Between a Volume and an Object* (on page 56).

Space Management Naming Rules

The software provides several options for naming Space Management items that you create. These naming rules are listed in the **GenericNameRules.xls** spreadsheet located in the ..\CatalogData\BulkLoad\DataFiles folder. For more information on creating naming rules, see the *Smart 3D Reference Data Guide*.
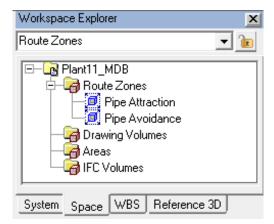
User Defined

Allows you to define a custom name for the volume. Type the name for the volume in the **Name** box. The default name is **Volume**.

Create Space Folder

🗀 Creates a new hierarchical folder for organizing your space objects. When you click **Create Space Folder** 🗀, a corresponding ribbon appears that allows you to define a parent and name for the new folder. You can create an indefinite hierarchy of spaces. You must create space folders in a permission group with write access or more in order to be able to add volumes to the space folders.

You can create folders to provide a hierarchical storage system for the space objects that you create in the **Space Management** task, just as you use folders to organize information in a filing cabinet.

The **Space** tab of the **Workspace Explorer** displays all the volumes in the workspace in a classification hierarchy that reflects the various relationships defined for the space objects. The content represents the current space objects loaded from the database into the active workspace. When you select a space object in the **Workspace Explorer**, the object appears highlighted with the select color in the active graphic view. Additionally, the software defaults to edit mode and displays the **Edit Volume** ribbon, which you can use to modify the selected space object.

Create Space Folder Ribbon

Sets options for creating a new space folder. After you have completed the required fields, you can click the **Space** tab in the **Workspace Explorer** to view the results.

🖼 **Properties**

Displays the *Space Folder Properties Dialog Box* (on page 105).

Finish

Creates the space folder with the **Name** and **Parent** properties that you specify.

Name

Specifies a name for the new space folder.

Parent

Specifies a location within the space hierarchy. The new space folder will become a child of the selected parent. Selecting **More** in the list opens the **Select Space Folder** dialog box, which displays the complete space hierarchy.

1. Click **Create Space Folder** 📁 on the vertical toolbar.

2. Specify a name for the folder in the **Name** box, or accept the default name.

3. Specify a parent for the folder in the **Parent** list.

   ☀TIP You can select **More** in the drop-down list to display the *Select Space Folder Dialog Box* (on page 13), which displays the full space hierarchy.

4. Click **Finish**.

☰NOTE You must create space folders in a permission group with write access or more in order to be able to add volumes to the space folders.

Select Space Folder Dialog Box

Specifies a parent for a folder or volume in the space hierarchy. This dialog box appears when you select **More** in the **Parent** box on the **Create Space Folder** ribbon. When you select **More** in the **Space folder** boxes on the volume creation and modification ribbons.
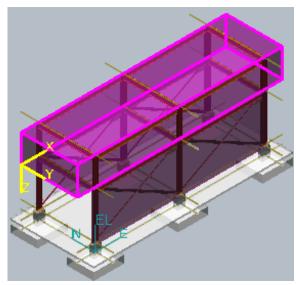
Look In

Specifies from which location you want the software to pull hierarchical information. You can retrieve hierarchical information from the workspace or from the entire model database.

Create Space Objects

Several methods of creating space objects, or volumes, exist in the **Space Management** task. You can provide two or four points to identify a rectangular cube, or you can select existing boundaries to define the space. The software links these space objects to their location coordinates relative to the global coordinate system.

Volumes are stored in the model. For example, when a task such as **Piping** is active, you can see the defined volumes on the **Space** tab of the **Workspace Explorer** making locating and manipulating volumes quick and easy. When creating a volume, you specify the type of volume: an area, zone, interference zone, region, or drawing volume. For drawing volumes, you cannot change the type after initial creation.

You can use SmartSketch glyphs and grids when you create space objects. You should also note the coordinate system triad that appears during volume creation. The orientation of a volume is helpful when you create volumes for drawings.

When you associate volumes with other objects in the model, if the associated objects change, then the size or dimensions of the volumes update accordingly. During volume creation and modification, you can specify whether the points of the volume are associated to objects in the model or not.

Placing Volumes Using Primitive Shapes

You can place a volume using a list of pre-defined volume types and shapes, and then provide dimensional information to further define the shape size. Using **Place Volume by Primitive Shapes** , you select a shape and specify the space type. You then identify a point in the model to place the shape origin point.

Place Volume by Two Points

Defines a volume by selecting two points to represent opposite vertices of the volume that you need. The two points can be located using standard tools, such as PinPoint, or by using SmartSketch relationship indicators.

By default, the software uses the global coordinate system to orient the rectangular volume relative to the placement points; however, you can use the **Coordinate system** list on the **PinPoint** ribbon to select a different active coordinate system. After the space object is placed, it maintains a local coordinate system that is used in future edits of the space object. The orientation of the space object does not change if the active coordinate system changes. For more information, see the *Common User's Guide*, available from the **Help > Printable Guides** command.

Place Volume by Two Points Ribbon

Sets options for placing volumes defined by opposite vertices using the **Place Volume by Two Points** command.

Volume Properties

Displays the *Properties Dialog Box* (on page 94), which allows you to set properties for the volume you are placing.

Volume Point 1

Defines the first point for the definition of the volume.

Volume Point 2

Defines the second point for the definition of the volume.

Name

Displays the default name for the space (as dictated by the active name rule), and allows you to type a different name, if needed.

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

Enable Assoc Point Creation

Specifies that the points of the volume are associative points, if the software detects constraints for the points. Associative points affect the behavior of the volume during modification such as movement or rotation.

⊗ Disable Assoc Point Creation

Specifies that the points of the volume are not associative points, even if the software finds constraints. You can click this button during or after volume placement. For example, during placement, you can use the default behavior at first (associative), and then click the non-associative option part-way through the construction process. When you specify the non-associative option, the software switches its behavior from associative to non-associative. The points that you created earlier retain their associativity.

▤ NOTES

- To indicate that the volume has associative points, the **Enable Assoc Point Creation** button is indented on the ribbon [⊘ ⊗] .

- To indicate that the volume has no associative points, the **Enable Assoc Point Creation** button is not indented on the ribbon, and the **Disable Assoc Point Creation** button is unavailable [⊘ ⊗] .

- If multiple volumes are selected, the **Enable Assoc Point Creation** button is not displayed. However, if at least one associative point exists, the **Enable Assoc Point Creation** button displays on the ribbon [▦ ⊗] .

▦ Break Association

Deletes the relationship between the volume and an object. Objects associated with a volume highlight when the volume is selected. This option is only available when modifying a selected volume that has an object associated with it.
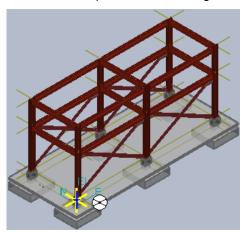
What do you want to do?

- *Place a volume by two points* (on page 16)
- *Place a volume by two points using PinPoint* (on page 18)
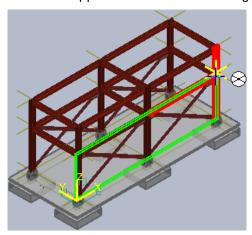
Place a volume by two points

1. Click **Place Volume by Two Points** ▱ .

2. Type a name for the volume in the **Name** box.

3. Select a volume type from the **Type** list.

   ♦ TIP The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

4. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.

5. To associate the points of the volume with points in the model, such as grid intersections, click **Enable Assoc Point Creation** ⊘. To drop the associative points during or after volume placement, click **Disable Assoc Point Creation** ⊗.

6. Define the first point of the rectangular volume.

7. Define the opposite corner of the rectangular volume.

The software places the volume.

Place a volume by two points using PinPoint

1. Click **PinPoint** .

2. Select the **Rectangular Coordinates** option on the **PinPoint** ribbon.

3. Click **Place Volume by Two Points** .

4. Type a name for the volume in the **Name** box.

5. Select a volume type from the **Type** list.

   TIP The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

6. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.
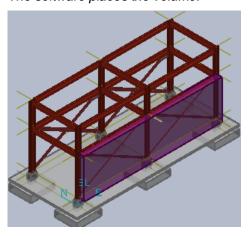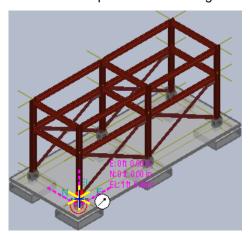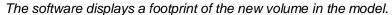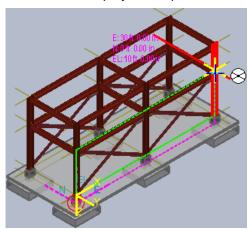
7. To associate the points of the volume with points in the model, such as grid intersections, click **Enable Assoc Point Creation** . To drop the associative points during or after volume placement, click **Disable Assoc Point Creation** .

8. Define the first point of the rectangular volume.
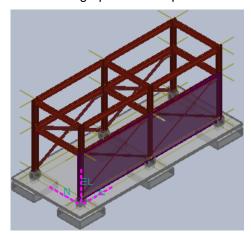
   TIP By default, the software displays help lines and distance values as you create the volume. You can use **Display On/Off** on the **PinPoint** ribbon to toggle the display on and off.

9. On the **PinPoint** ribbon, type the easting, northing, and elevation coordinates of the volume that you want to place.

The software displays a footprint of the new volume in the model.

10. Click in the graphic view to place the volume.

📑 **NOTES**

- If you select a different coordinate system in the **Coordinate System** field, you must also click **Set Target to Origin** to reset the ribbon values.

- You can use function keys with the **PinPoint** command. Press **F6** to lock and unlock the E (X) value or absolute distance. Press **F7** to lock and unlock the N (Y) value or horizontal angle. Press **F8** to lock and unlock the EL (Z) value or vertical angle. Press **F9** to turn the display of help lines and distance values on and off. Press **F12** to reposition the target.

Select System Dialog Box

Specifies the type of space needed for placement. This dialog box appears when you select **More** in the **Type** box on a horizontal ribbon. By browsing through the space hierarchy, you can find any type of space object defined in the catalog database. After you select a space object, the software returns you to the model, where you can finalize configuration and placement of the space.

Save

Saves the active row to the catalog database. This command is available only in the **Catalog** task.

Copy

Copies the selected object. This command is available only in the **Catalog** task.

Paste

Pastes a copied object. This command is available only in the **Catalog** task.

Delete

Deletes the selected object. This command is available only in the **Catalog** task.

Undo

Reverses the most recent operation. This command is available only in the **Catalog** task.

Insert Row

Inserts a blank row into the grid view. This command is available only in the **Catalog** task.

Move Up

Moves the select list entry up one in the editable grid. This command is available only in the **Catalog** task.

Move Down

Moves the select list entry down one in the editable grid. This command is available only in the **Catalog** task.

Properties

Displays the properties of the selected object. The properties on this dialog box are read-only.

Preview

Opens a bitmap file that was assigned to a part or part class in the reference data.

Filter

Filters the data in the content view to quickly find what you are looking for. This command is available only in the **Catalog** task.

Sort

Sorts data in the content view by multiple columns to quickly find what you are looking for. This command is available only in the **Catalog** task.

Customize Current View

Controls which property columns display in the content view and in what order. This command is available only in the **Catalog** task.

List View

Displays the information in the content view in a list format.

Grid View

Displays the information in the content view in a table format.

Back

Highlights the last selected item or folder.

Forward

Advances the display forward to return the browser display to the last item that you selected before you used **Back** ⬅.

Up One Level

Moves the focus up one level in the catalog hierarchy.

Check Data

Checks the consistency of the data in the grid against other data in the catalog. This command is available only in the **Catalog** task.

Help

Displays online Help for the active task.

Address

Specifies your exact location within the displayed hierarchy.

See Also

Create Space Objects (on page 14)
Space Management (on page 8)

Place Volume by Four Points

Defines a space by typing three points to define a base plane and a fourth point to define elevation or depth. By selecting the three planar points in the plan view, you can ensure that the volume is parallel to the base elevation plane of your design.

Place Volume by Four Points supports rotated views, which you can use with volume drawing types in the **Drawings and Reports** task to create a rotated view on a drawing. The first and second points specified determine the X-axis orientation of the view on the resulting drawing.

By default, the software uses the global coordinate system to orient the rectangular volume relative to the placement points; however, you can use the **Coordinate system** list on the **PinPoint** ribbon to select a different active coordinate system. After the space object is placed, it maintains a local coordinate system that is used in future edits of the space object. The orientation of the space object does not change if the active coordinate system changes. For

more information, see the *Common User's Guide*, available from the **Help > Printable Guides** command.

Place Volume by Four Points Ribbon

Sets options for placing a volume defined by three planar points and an elevation point.

Volume Properties

Displays the *Properties Dialog Box* (on page 94), which allows you to set properties for the volume that you are placing.

Volume Point 1

Sets the first point for the definition of the volume.

Volume Point 2

Places the second point for definition of the volume, which determines the length of the volume along the X-axis.

The **Place Volume by Four Points** command supports rotated views, which you can use with volume drawing types in the Drawings and Reports task to create a rotated view on a drawing. The first and second points specified in the command determine the X-orientation of the view on the resulting drawing.

Volume Point 3

Defines the third point for the space to be created, which determines the length of the volume along the Y-axis, and defines a horizontal plane of the surface.

Volume Point 4

Sets the elevation of the new volume along the Z-axis.

Name

Displays the default name for the space (as dictated by the active name rule), and allows you to type a different name, if needed.

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

Break Association

Deletes the relationship between the volume and an object. Objects associated with a volume highlight when the volume is selected. This option is only available when modifying a selected volume that has an object associated with it.

How to Place a Volume by Four Points

1. Click **Place Volume by Four Points** .

2. Type a name for the volume in the **Name** box.

3. Select a volume type from the **Type** list.

    TIP The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

4. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.

5. Select three points to define a plane.

6. Select a fourth point to define the elevation from your defined plane for the volume.
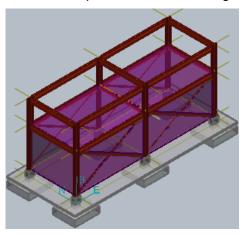
The software places the volume using the four points you defined.

NOTE You can also define the rectangular volume by using **PinPoint** .

Place Volume by Window

 Defines a volume based on the active graphic view of the model. You can use this command to quickly create a volume in the active view, similar to taking a snapshot. The window boundaries, view depth range, and clipping are used when creating the volume. You can edit the resulting volume in the same way as you edit a volume by two points.

By default, the software uses the global coordinate system to orient the rectangular volume relative to the placement points; however, you can use the **Coordinate system** list on the **PinPoint** ribbon to select a different active coordinate system. After the space object is placed, it maintains a local coordinate system that is used in future edits of the space object. The orientation of the space object does not change if the active coordinate system changes. For more information, see the *Common User's Guide*, available from the **Help > Printable Guides** command.

Place Volume by Window Ribbon

Sets options for placing a volume defined by an existing graphic view of the model.

Volume Properties

Displays the *Properties Dialog Box* (on page 94) dialog box, which allows you to set properties for the volume that you are placing.

Finish

Places the volume.

Name

Displays the default name for the space (as dictated by the active name rule), and allows you to type a different name, if needed.

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

Break Association

Deletes the relationship between the volume and an object. Objects associated with a volume highlight when the volume is selected. This option is only available when modifying a selected volume that has an object associated with it.

How to Place a Volume by Window

1. Click inside the graphic window to use.

2. Click **Place Volume by Window** .

The right window was the active window when the command was selected. You can see in the left window the volume that will be created after you click **Finish**

3. Type a name for the volume in the **Name** box.

4. Select a volume type from the **Type** list.

   TIP The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

5. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.

6. Click **Finish**.

Place Volume by Selection

Defines a space by placing a rectangular volume around a set of selected objects. You can edit the resulting volume in the same way as you edit a volume by two points. This command is similar to the *Place Drawing Volume by Selection* (on page 60).

By default, the software uses the global coordinate system to orient the rectangular volume relative to the placement points; however, you can use the **Coordinate system** list on the **PinPoint** ribbon to select a different active coordinate system. After the space object is placed, it maintains a local coordinate system that is used in future edits of the space object. The orientation of the space object does not change if the active coordinate system changes. For more information, see the *Common User's Guide*, available from the **Help > Printable Guides** command.

Place Volume by Selection Ribbon

Sets options for placing a volume defined by the range around a set of objects in the model.

Volume Properties

Displays the *Properties Dialog Box* (on page 94), which allows you to set properties for the volume that you are placing.

Select objects

Allows you to pick objects in a graphic view or in the **Workspace Explorer**.

Finish

Places the volume.

Name

Displays the default name for the space (as dictated by the active name rule), and allows you to type a different name, if needed.

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

Volume Height

Allows you to type the length or the depth of the volume to create using a grid line or a structural edge.
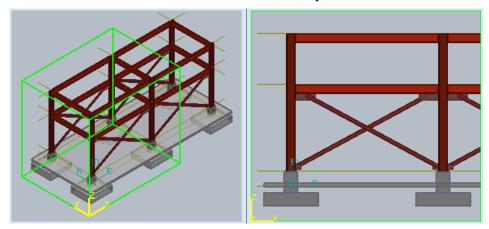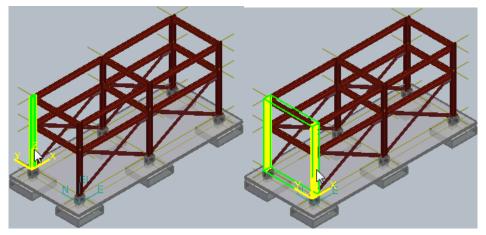
Break Association
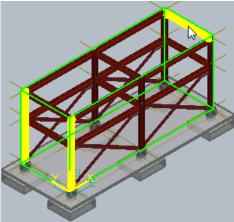
Deletes the relationship between the volume and an object. Objects associated with a

volume highlight when the volume is selected. This option is only available when modifying a selected volume that has an object associated with it.
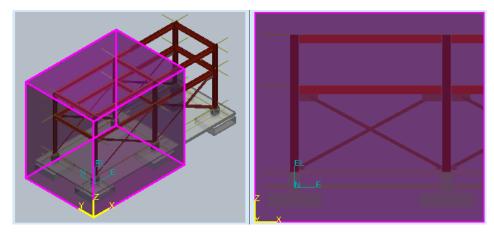
How to Place a Volume by Selection
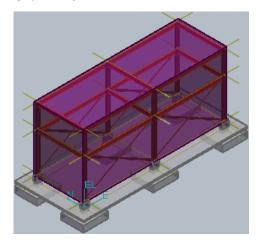
1. Click **Place Volume by Selection** 🔳.

2. Select objects in the model. You can select the objects using a custom filter if necessary.

3. Type a name for the volume in the **Name** box.

4. Select a volume type from the **Type** list.

    💡**TIP** The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

5. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.

6. Click **Finish**.
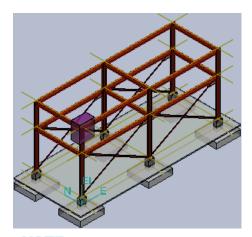
NOTES

- You can also place a volume by selecting linear objects and by using the **Volume Height** option. This option is available when you select a linear object such as a grid line or a structural edge, or two or more lines in the same plane. The value you type in the **Volume Height** option can be the length, width, or depth of the resulting volume. Examples are as follows:

  - When you select a single grid line, the value you type becomes the length and width of the resulting volume. The grid line is your centerline and the depth of the volume.

  - When you select two or more grid lines in the same plane, the value you type becomes the depth of the resulting volume.

Place Volumes by Plane and Offset

Defines rectangular volumes based on a plane and offsets from that plane. When using this command, you identify one or more planes, and then specify two offset values from the plane. Finally, you drag a fence to define the limits of the volumes to be created. The software creates a volume for each selected plane.

This command is useful if you want to create drawings at periodic locations, for example, at the intersections of columns along a beam or at platforms along a distillation tower.

NOTE You cannot move or rotate volumes placed with this command.

By default, the software uses the global coordinate system to orient the rectangular volume relative to the placement points; however, you can use the **Coordinate system** list on the **PinPoint** ribbon to select a different active coordinate system. After the space object is placed, it maintains a local coordinate system that is used in future edits of the space object. The orientation of the space object does not change if the active coordinate system changes. For more information, see the *Common User's Guide*, available from the **Help > Printable Guides** command.

Place Volumes by Plane and Offset Ribbon

Sets options for placing volumes defined by a plane and offsets from that plane.

Volume Properties

Displays the *Properties Dialog Box* (on page 94), which allows you to set properties for the volumes that you are placing.

Select Reference Plane

Selects one or more reference planes from the model or **Workspace Explorer**. If you select multiple planes, they must all be parallel.

Select Three Points

Defines a plane by three points in the model. These three points must not be collinear. The plane defined by the three points is projected to the offset planes. You can change the view perspective to assist in defining this plane.

Finish

Generates the defined volumes and exits the command.

Reject

Cancels the selections and allows you to select different objects.

Accept

Accepts the selections.

Plane Method

Specifies how you want to define the reference planes in this command. Of all the available

plane methods, only two allow the creation of multiple volumes: **Coincident** and **Offset from Plane**. All other plane method options create a single volume.

- Select **Coincident** 🏶 to specify a plane that is on another plane.

- Select **Offset from Plane** 📎 to specify a plane that is a specified distance from another plane. If you choose this option, you must define the offset distance.

- Select **Angle to Plane** 🔌 to specify a plane at a specified angle or slope to another plane. If you choose this option, you must define an axis of rotation and the angle or slope.

- Select **Vector & Point** 🔲 to specify a plane using two points to define a vector normal to the plane and a third point to define the plane position along the vector.

- Select **3 Point Plane** 🔲 to specify a plane using three points in the model.

Offset 1

Defines the first offset plane.

Offset 2

Defines the second offset plane.

★ **IMPORTANT** **Offset 1** must be greater than **Offset 2**.

Name

Displays the default name for the space (as dictated by the active name rule), and allows you to type a different name, if needed.

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

⊘ **Enable Assoc Point Creation**

Specifies that the points of the volume are associative points, if the software detects constraints for the points. Associative points affect the behavior of the volume during modification such as movement or rotation.

⊗ **Disable Assoc Point Creation**

Specifies that the points of the volume are not associative points, even if the software finds constraints. You can click this button during or after volume placement. For example, during placement, you can use the default behavior at first (associative), and then click the non-associative option part-way through the construction process. When you specify the non-associative option, the software switches its behavior from associative to non-associative. The points that you created earlier retain their associativity.

📄 NOTES

- To indicate that the volume has associative points, the **Enable Assoc Point Creation** button is indented on the ribbon ⊘⊗ .

- To indicate that the volume has no associative points, the **Enable Assoc Point Creation** button is not indented on the ribbon, and the **Disable Assoc Point Creation** button is unavailable ⊘⊗ .

- If multiple volumes are selected, the **Enable Assoc Point Creation** button is not displayed. However, if at least one associative point exists, the **Enable Assoc Point Creation** button displays on the ribbon 📋 ⊗ .

Break Association

Deletes the relationship between the volume and an object. Objects associated with a volume highlight when the volume is selected. This option is only available when modifying a selected volume that has an object associated with it.

How to Place Volumes by Plane and Offset

1. Click **Place Volumes by Plane and Offset** 🔷.

2. To associate the points of the volume with points in the model, such as grid intersections, click **Enable Assoc Point Creation** ⊘. To drop the associative points during or after volume placement, click **Disable Assoc Point Creation** ⊗.

3. Select one or more reference planes.

   💡 TIPS If you select multiple planes, the planes must all be parallel.
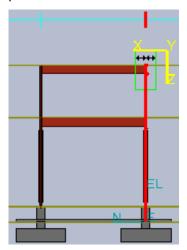
4. Click **Accept** ✓.

5. Click three points in the model to define a plane. These three points must not be collinear.

The plane defined by the three points is projected to the offset planes.
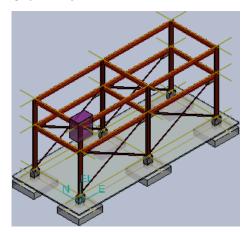
6. In the **Offset 1** and **Offset 2** boxes, type or select values to define the offset planes. These planes are offset from the reference plane that you selected.

7. Type a name for the volume in the **Name** box.

8. Select a volume type from the **Type** list.

   🔆**TIP** The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

9. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.

10. Click **Finish**.

NOTE You can use **PinPoint** and SmartSketch relationship indicators when specifying the planes and offsets in this command.

Place Volumes by Grids
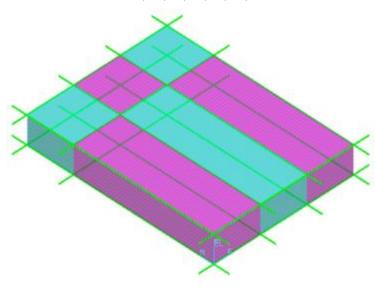
Creates many volumes at once, based on a set of grid and elevation planes. All of the input planes must be from the same coordinate system. You must select at least two planes in each direction.

To place volumes for cylindrical, radial or angled grids, you must use **Place Volume Using Primitive Shapes** . For more information, see *Place Volume Using Primitive Shapes* (on page 53).

NOTES

- 4 E (X) grid planes
- 3 N (Y) grid planes
- 2 EL (Z) planes

Number of Volumes = (4-1) * (3-1) * (2-1) = 3 * 2 * 1 = 6

Place Volumes by Grids Ribbon

Sets options for creating multiple volumes at one time.

Volume Properties

Displays the **Volume Properties** dialog box, which allows you to set properties for the volumes that you are placing.

Select Grid and Elevation Planes

Allows you to select grid and elevation planes from the **Workspace Explorer** or the graphic view.

Finish

Generates the defined volumes and exits the command.

✕ Reject Boundaries

Rejects the selected planes and allows you to continue the selection step.

✓ Accept for Preview

Accepts the selected planes and graphically displays the resulting volumes.

Name

Displays the default name for the volumes (as dictated by the active name rule), and allows you to type a different name, if needed.

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

⊘ **Enable Assoc Point Creation**

Specifies that the points of the volume are associative points, if the software detects constraints for the points. Associative points affect the behavior of the volume during modification such as movement or rotation.

⊗ **Disable Assoc Point Creation**

Specifies that the points of the volume are not associative points, even if the software finds constraints. You can click this button during or after volume placement. For example, during placement, you can use the default behavior at first (associative), and then click the non-associative option part-way through the construction process. When you specify the non-associative option, the software switches its behavior from associative to non-associative. The points that you created earlier retain their associativity.

NOTES

- To indicate that the volume has associative points, the **Enable Assoc Point Creation** button is indented on the ribbon ⊘⊗.

- To indicate that the volume has no associative points, the **Enable Assoc Point Creation** button is not indented on the ribbon, and the **Disable Assoc Point Creation** button is unavailable ⊘⊗.

- If multiple volumes are selected, the **Enable Assoc Point Creation** button is not displayed. However, if at least one associative point exists, the **Enable Assoc Point Creation** button displays on the ribbon 🗔⊗.

🔗 **Break Association**

Deletes the relationship between the volume and an object. Objects associated with a volume highlight when the volume is selected. This option is only available when modifying a selected volume that has an object associated with it.

How to Place Volumes by Grids

1. Click **Place Volumes by Grids** 🔳 on the vertical toolbar.

2. To associate the points of the volume with points in the model, such as grid intersections, click **Enable Assoc Point Creation** ⊘. To drop the associative points during or after volume placement, click **Disable Assoc Point Creation** ⊗.

3. Select grid and elevation planes in the **Workspace Explorer** or in a graphic view, and then click **Accept** ✓.

   TIPS

   - You must select at least two planes in each direction.

   - All of the input planes must be from the same coordinate system.

4. Type a name for the volume in the **Name** box.

5. Select a volume type from the **Type** list.

   TIP The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

6. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.

7. Click **Finish**.

NOTE You can continue creating volumes using **Place Volumes by Grids** , even overlapping pre-existing volumes created with this command. It is not possible to "use up" the grid.

Create Volume Bound by Spaces

 Defines a volume by selecting sufficient bounding spaces to create a closed volume. This command is particularly useful in placing volumes defined as areas that cannot overlap. By using existing areas to define a new volume, you can avoid the problem of creating conflicts among defined volumes in the model.

The sub-volumes that are grouped under the bound by spaces volume can be selected graphically or from the **Workspace Explorer**. Deleting a bound by spaces volume deletes the individual integrity of the sub-volumes but does not delete the sub-volumes. To use a volume as a sub-volume for creation of a bound by spaces volume, you must have **Full Access** permissions on the space object, and its status must be set to **Working**.

Create Volume Bound by Spaces Ribbon

Sets options for defining a new volume by selecting sufficient bounding surfaces from existing spaces to define a new closed volume.

 Volume Properties

Displays the **Volume Properties** dialog box, which allows you to set properties for the volume that you are placing.

 Volume Selection

Allows you to select the spaces that will serve as boundaries for the new volume.

 Volume List

Displays the *Volume List Dialog Box* (on page 39), from which you can view all information about the boundaries available in the model. You can also use this dialog box to either add or remove volumes, or you can rearrange their position with the list.

Finish

Generates the defined volume and exits the command.

✕ **Reject Selection**

Removes the selected volume from the volume list and allows you to continue the volume selection step.

✓ **Accept Selection**

Accepts the selected volumes and graphically displays the resulting volume.

Name

Displays the default name for the space (as dictated by the active name rule), and allows you to type a different name, if needed.

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

How to Create a Volume Bound by Spaces

1. Click **Create Volume Bound by Spaces** 🔲.

2. Select the first volume that you want to use to create the new volume. You can select the spaces graphically or from the **Workplace Explorer**.

3. Select additional volumes to add. The spaces that you select can touch or overlap.

4. Review the selected spaces and make any necessary changes using the **Volume List** dialog box. For more information, see *Volume List Dialog Box* (on page 39).

5. Type a name for the volume in the **Name** box.

6. Select a volume type from the **Type** list.

   💡 **TIP** The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

7. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.

8. Click **Accept Selected Volumes** to view the bound volume.

9. Click **Finish** to generate the new volume and save it to the database.

Volume List Dialog Box

Sets options for merging spaces using **Merge Volumes** 🗄 and for defining a space using **Create Volume Bound by Spaces** 🗗. The **Name** and **Type** properties are read-only.

Name

Displays the name of the volume. You can edit this value on the *Properties Dialog Box* (on page 94).

Type

Displays the type of volume. You can edit this value on the **Volume Properties** dialog box.

Add Space

Allows you to select additional sub-volumes (graphically or from the **Workspace Explorer**) to add to the current bound volume definition. First, select a sub-volume in a graphic view or from the **Workspace Explorer**, and then click **Add Space** to add it to the list.

Remove Space

Allows you to select a sub-volume (graphically, or from the **Workspace Explorer**, or on this dialog box) and then remove the selected volume from the bound volume definition.

OK

Commits the add and remove actions for the volumes, and closes the dialog box.

Cancel

Cancels all volume selections, closes the dialog box, and resets the volume list contents to the initial list that appeared when the volume list was activated.

Apply

Commits the add and remove actions for the volumes. You can continue adding or removing volumes.
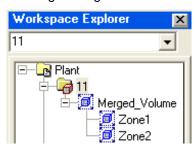
Clear All

Removes all items from the current list. The dialog box remains open, and you can add or remove volumes as needed.

Merge Volumes

🗄 Merges multiple existing volumes into a single new space. By using the **Volume List** box to define the spaces to add or remove from the merged space, this command allows for the placement of more complex space shapes than the standard placement commands. For example, with this command, you can create an L-shaped space by merging two overlapping rectangular spaces. The resulting space inherits the properties of the first space that you select for the merge.

When this command is used, the existing spaces are consumed in the merge operation; consequently, the sub-volumes are no longer available as separate entities. The software removes them from the graphic views and groups them under the merged volume in the **Workspace Explorer**. In this graphic, **Merged_Volume** was created from **Zone1** and **Zone2**. Deleting a merged volume deletes all of the sub- volumes associated with it.

Merge Volumes Ribbon

Sets options for merging existing spaces into a single new space.

Volume Properties

Displays the **Volume Properties** dialog box, which allows you to set properties for the volume that you are placing. By default, the new merged space inherits the properties of the first space that you select for the merge.

Volume Selection

Allows you to select the spaces to incorporate in the new volume.

Volume List

Displays the *Volume List Dialog Box* (on page 39), which displays information about the volumes available in the model. You can use this dialog box to either add or remove volumes, or you can rearrange their position in the list.

Finish

Generates the defined volume and exits the command.

✕ Reject Selection

Removes the selected volume from the volume list and allows you to continue the volume selection step.

✔ Accept Selection

Accepts the selected volumes and graphically displays the resulting volume.

Name

Displays the default name for the space (as dictated by the active name rule), and allows you to type a different name, if needed.

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

1. Click **Merge Volumes** ⊞ on the vertical toolbar.

2. Select the first volume that you want to merge from a graphic view or from the **Workspace Explorer**.

3. Select additional volumes to add. You can merge volumes that are adjacent or overlapping.

4. Review the selected spaces and make any necessary changes using the **Volume List** dialog box. For more information, see *Volume List Dialog Box* (on page 39).

5. Type a name for the volume in the **Name** box.

6. Select a volume type from the **Type** list.

   ● TIP The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

7. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.

8. Click **Accept Selected Volume** ✓ to view the merged volume.

9. Click **Finish** to generate the new volume and save it to the database.

▤ NOTES

▪ To use a volume as a sub- volume for creation of a merged volume, you must have Full Access permissions on the space object, and its status must be set to **Working**.

▪ You can delete, copy, or paste a merged space.

▪ Unlike bound volumes, the act of creating a merged volume is not reversible. If you delete the merged volume, all the volumes that were merged are permanently lost.

Place Volume Along Path

 Sketches a path in three-dimensional space, defines a cross-section, and projects the cross-section along the path to define a volume. The path can consist of both straight lines and arcs.

Using the **Type** box, you can associate the volume with a design specification from the catalog database.

In the **Space Management** task, you can create customized volumes in the location that you need and with the shape that you need using **Place Volume Along Path** . This command is especially useful for volumes that need to have an unusual, custom shape or that must negotiate around specific objects in the model. For example, if you need to leave adequate space for a crane, stretcher, or other equipment to reach a particular location, **Place Volume**

Along Path ⊞ allows you to specify the path where the equipment needs to travel, as well as the appropriate amount of clearance that must be left on all sides.

When you place a volume along a path, the software projects a two-dimensional cross-section along the path that you specify in the model to create the volume. The path determines the location of the volume in the model. The cross-section defines the shape and dimensions of the volume.
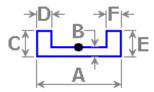
Defining Paths

When you define the path along which a cross-section will be projected, you can choose from straight lines or arcs. If you want to break the path at a particular point, you can select **No Line** ⤴. You can also control all aspects of the path by specifying the types of turns, the dimensions of the turns, and the plane for the path.

Defining Cross-sections

When you define the cross-section for the volume, you can select from a standard set of cross-sections, defined in the reference data, or you can sketch your own two-dimensional cross-section.

When you use a standard cross-sectional type, you can change the dimensions and the cardinal point of the cross-section on the **Cross-Section** tab on the **Volume Properties** dialog box. The cardinal point of the cross-section is important in determining the shape and location of the resulting volume. The cardinal point is the point at which you want the software to attach the cross-section to the path. All standard cross-section types have cardinal points from which you can choose.

For example, in this graphic, you can see that the cardinal point is located in the center of the cross-section. If the cardinal point were moved to another location, the actual path would be different.

When you sketch a cross-section, you must sketch the cross-section on the two-dimensional plane that is orthogonal to the first leg of the path. The software displays this plane, which is perpendicular to the path, as you sketch the cross-section. The cardinal point is defined as you sketch. In other words, the cross-section surrounds the path and is attached to the path exactly as you sketch it.

📝 **NOTE** The faces of the volumes created using **Place Volume Along Path** ⊞ can be located by the SmartSketch service.

Place Volume Along Path Ribbon

Sets options for placing volumes defined by a path and a cross-section projected along the path.

🗔 **Properties**

Displays the **Volume Properties** dialog box, which allows you to set properties for the volume that you are placing.

⇄ **Path**

> Displays the **Create Path** ribbon, which allows you to define the path along which the volume will be created.

▭ **Cross-Section**

> Sets properties for the cross section. If you select one of the standard cross-sectional types in the **Cross-Section** box, this button displays the *Cross-Section Tab (Volume Properties Dialog Box)* (on page 102) to allow you to modify the properties of the cross-section. If you select **Sketch** as the cross-sectional type, this button displays the **Create Path** ribbon to allow you to sketch the two-dimensional cross-section. The **Cross-Section** button is only available after you define a path for the volume.

Finish

> Places the volume along the specified path with the specified cross-section.

Cross-Section

> Specifies the type of cross section that you want to project along the specified path. You can select a standard cross section defined in the reference data, or you can sketch your own custom cross section.

Name

> Displays the default name for the space (as dictated by the active name rule), and allows you to type a different name, if needed.

Type

> Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

> Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

Create Path Ribbon

Sets options for defining a new path.

🗏 **Properties**

> Displays the **Sketch Properties** dialog box, which allows you to view properties for the path.

Finish Path

> Displays the path in the active graphic view and returns to the **Place Volume Along Path** command.

Cancel

> Cancels the changes that you have made and returns you to the model.

Edit

Allows you to modify and move the existing path. When you initially create a path, this option is only available after you place at least two points in the path. You can select a segment, a turn, or multiple segments to which you want to make modifications.

Create

Sketches the path or adds segments to an existing path.

Reference Point

Specifies that you are defining the first point of the path segment.

Second Point (Arc)

Specifies that you are defining the second point of an arc. This option only appears when you select **Arc by Three Points** or **Arc by End Points** in the **Path Type** list.

End Point

Specifies that you are defining the end point of a straight path segment or an arc.

Path Type

Specifies the type of line for the current segment in the path. To change the segment type, select a different type in the **Path Type** list.

- **Line** - Specifies a straight line for the segment.

- **Arc by 3 Points** - Specifies an arc by three points for the segment. The first point is the start of the arc, the second point is a point on the arc, and the third point is the end of the arc.

- **No Line** - Specifies that you do not want the current segment of the path to have a line associated with it.

- **Arc by End Points** - Specifies an arc by end points for the segment. The first point you click is the start of the arc; the second point you click is the end of the arc; the third point you click defines the plane, radius, and sweep angle of the arc.

- **Elliptical Arc** - Specifies an elliptical arc for the segment. The first point you click is the start of the arc; the second point you click is the center of the ellipse; the third point you click defines the minor/major axis ratio and the sweep angle.

Plane

Activates options for selecting a working plane for the path.

- **Plan Plane** - Defines the work surface as the XY plane. You can also press CTRL+1 to select this option.

- **Z Plane: X-West / Elevation Plane: East-West** - Defines the work surface as the XZ plane. You can also press CTRL+2 to select this option.

- **Section Plane: Y- South / Elevation Plane: North-South** - Defines the work surface as the YZ plane. You can also press CTRL+3 to select this option.

- **Plane by Turn** - Defines the work surface as the plane defined by an existing turn. You select the turn to set the plane. You can also press CTRL+4 to select this option.

- **Plane by Three Points** - Defines the work surface using three points you define. You can also press CTRL+5 to select this option.

- ▪ ✖ **No Plane** - Clears any work surfaces. The software does not project points that you place to any plane. You can also press CTRL+6 to select this option.

🔒 Lock Angle

Locks or unlocks the **Angle** box. This option appears for the **Line** path type.

Angle

Specifies the angle for the segment. This option appears for the **Line** path type.

🔒 Lock Length

Locks or unlocks the **Length** box. This option appears for the **Line** path type.
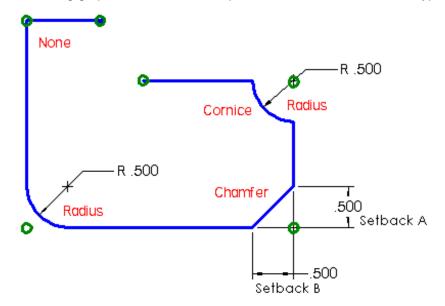
Length

Specifies the length of the selected path segment. This option appears for the **Line** path type.

Turn Type

Specifies the type of turn associated with the current path segment.

- ▪ **None** - Indicates that no special turn type is applied to the turn.

- ▪ **Bend** - Specifies that the turn type between two segments is a bend. You can specify the angle of the bend in the **Value** box.

- ▪ **Cornice** - Specifies that the turn type between two segments is a cornice. You can specify the radius of the cornice in the **Value** box.

- ▪ **Chamfer** - Specifies that the turn type between two segments is a chamfer. You can specify the dimensions for setback A and setback B of the chamfer in the **Value** box. The dimensions of setback A and setback B for the chamfer must be the same.

The following graphic includes an example of each of the available turn types:

Value

Defines dimensions for the selected turn type.

Offset

Type or select the offset between the path and the working plane.

Lock Radius

Locks or unlocks the **Radius** box. This option appears for the **Arc by End Points** path type.

Radius

Specifies the distance between the center of the arc and an end point of the arc. This option appears for the **Arc by End Points** path type.
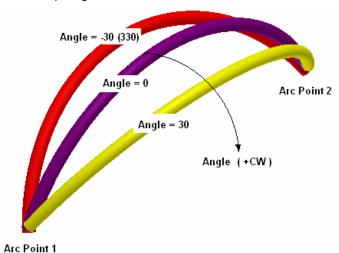
Lock Sweep

Locks or unlocks the **Sweep** box. This option appears for the **Arc by End Points** path type.

Sweep

Specifies the clockwise angle of the arc as looking from endpoint 1 to endpoint 2 of the arc. This option only appears for the **Arc by End Points** path type. The following picture shows the sweep angle.

Lock Minor/Major

Locks or unlocks the **Minor/Major** box. This option only appears for the **Elliptical Arc** path type.

Minor/Major

Shows the ratio between the minor and major axes for the arc. This option only appears for the **Elliptical Arc** path type.
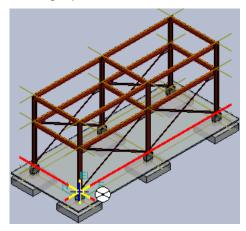
What do you want to do?

- *Place a volume along a path* (on page 47)
- *Define a path for a volume* (on page 49)
- *Define a line* (on page 50)
- *Define an arc by three points* (on page 50)

- *Define an arc by end points* (on page 51)
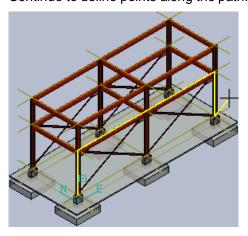
- *Define an elliptical arc* (on page 51)

- *Define cross-sectional properties for a volume* (on page 51)

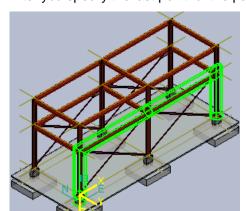- *Sketch the cross-section for a volume* (on page 52)

Place a volume along a path

1. Click **Place Volume Along Path** .

2. Define the starting point for the path. See *Define a path for a volume* (on page 49) for help defining a path.

3. Continue to define points along the path.

4. After you specify the last point for the path, click **Finish** to close the path ribbon.

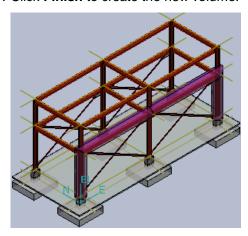5. From the **Cross-Section** list, select the cross-section type.

6. Click **Cross-Section** ▭ to define properties for the cross-section or to sketch the cross-section.

   Sketch the Cross-Section for a Volume (on page 52)

   Define Cross-Sectional Properties for a Volume (on page 51)

   TIP Whether you define cross-sectional properties or sketch your own cross-section depends on the cross-sectional type that you select in the **Cross-Section** list. If you select **Sketch** as the cross-sectional type, you can draw a two-dimensional cross-section in the model using the **Create Path** ribbon. If you select one of the standard cross-sectional types defined in the reference data, you can modify the properties of the cross-section on the **Volume Properties** dialog box.

7. Type a name for the volume in the **Name** box.

8. Select a volume type from the **Type** list.

   TIP The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

9. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.

10. To associate the points of the volume with points in the model, such as grid intersections, click **Enable Assoc Point Creation** ⊘. To drop the associative points during or after volume placement, click **Disable Assoc Point Creation** ⊗.

11. Click **Finish** to create the new volume.

Define a path for a volume

1. On the ribbon, click **Path** ⤵.

2. Click a point for the first segment. Next, decide what type of segment you want, and follow the corresponding link.

   Define a line (on page 50)

   Define an arc by three points (on page 50)

   Define an arc by end points (on page 51)

   Define an elliptical arc (on page 51)

3. Click to place other segments of the path as needed.

4. After you place all the points that define the path, click **Finish**.

📑 **NOTES**
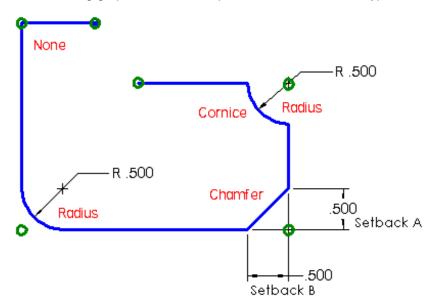
- You can use **PinPoint** , **Point Along** , and the SmartSketch relationship indicators when defining a path.

- To break the path, click **No Line** in the **Path Type** list.

- You can change the plane for the path at any time by selecting a different plane in the **Plane** list.

- In the **Offset** box, you can specify the distance from the path segment to the working plane, if needed.

- The software does not require that you close the path for a volume. When creating a continuous path, you can end it wherever you want.

- After you place a segment of the path, you can click **Edit** on the ribbon to change the segment.

Define a line

1. In the **Path Type** list, click **Line** ╱.

2. In the **Angle** box, type a value to constrain the angle of the line, if needed. You can also lock the angle.

3. In the **Length** box, type a value to constrain the length of the line, if needed. You can also lock the length.

4. In the **Turn Type** box, specify a turn, if needed. For example, you can select **Bend**, **Cornice**, or **Chamfer**.

    ### ♥ TIPS

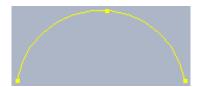   ▪ You can specify a value for the dimensions of the turn in the **Value** box.

    ▪ The following graphic shows examples of the available turn types:

5. Click the end point for the line.
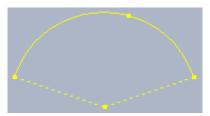
Define an arc by three points

1. In the **Path Type** list, click **Arc by 3 Points** ⌒.

2. Click to place the second point for the arc. This point lies on the arc.

3. Click to place the third and last point for the arc.

Define an arc by end points

1. In the **Path Type** list, click **Arc by End Points** .

2. Click to place the second end point for the arc.

3. Click to place a point on the arc.

📑 NOTES

▪   You can use the **Radius** and **Sweep** boxes on the ribbon to control the parameters of the arc.

▪   The radius cannot be less than half the distance between the two end points of the arc.

Define an elliptical arc

1. In the **Path Type** list, click **Elliptical Arc** .

2. Click to place the center point of the ellipse.

3. Click to place the end point of the arc.

📑 NOTES

▪   You can use the **Minor/Major** and **Sweep** boxes on the ribbon to control the parameters of the arc.

▪   The **Minor/Major** box shows the ratio between the minor and major axes of the ellipse.

Define cross-sectional properties for a volume
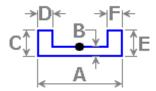
1. On the **Place Volume Along Path** ribbon, select a cross-sectional type in the **Cross-Section** list.

    💡 TIP If you select **Sketch** in the **Cross-Section** list, you must sketch the cross-section using the **Path** commands before you can edit properties.

2. On the ribbon, click **Cross-Section** .

3. On the **Volume Properties** dialog box, click the **Cross-Section** tab.

4. Define values for each dimension of the cross-section. Letters such as A, B, and C represent the cross- sectional dimensions.

   ### 💡 TIPS

   - To see what each lettered dimension represents on the cross-section, click **Display Cross-Section Image** 🖼 to view a graphic of the selected cross-sectional type (if a corresponding graphic exists in the reference data). Not all cross-sectional types have images associated with them.

   - Cross-sectional images show the dimensions that you can define for the cross-sectional type, the default cardinal points for the cross-sectional type, and the angle for the cross-section. This graphic contains the dimensions and cardinal point for an example cross-section:

5. Select the cardinal point for the cross-section in the **Cardinality** list.

   ### 💡 TIPS

   - The cardinal point is the point at which you want the software to attach the cross-section to the path.

   - When you change the cardinal point, the software automatically updates the display in the model.

6. Type an **Angle** for the cross-section, if needed.

   📝 **NOTE** You cannot modify the properties of a sketched cross-section on the **Volume Properties** dialog box. Instead, you must make changes to the path that defines the cross-sectional sketch. For more information, see *Modify a Sketched Cross-section* (on page 79).

Sketch the cross-section for a volume

1. On the ribbon, select **Sketch** in the **Cross-Section** list.

2. On the ribbon, click **Cross-Section** ▭.

3. Click a point for the first segment. Then, decide what type of segment you want, and follow the corresponding link.

   Define a line (on page 50)
   Define an arc by three points (on page 50)
   Define an arc by end points (on page 51)
   Define an elliptical arc (on page 51)

4. Click to place other segments of the cross-section as needed.

5. Click the starting point of the cross-section to close it.

6. Click **Finish**.

TIP The **Finish** button is not available until you close the cross-section by clicking the starting point.

NOTES

- You must sketch the cross-section on the two-dimensional plane that is orthogonal to the first leg of the path. The software displays this plane, which is perpendicular to the path, as you sketch the cross-section.

- The cardinal point, which is the point at which the cross-section is attached to the path, is defined as you sketch. In other words, the cross-section surrounds the path and is attached to the path exactly as you sketch it.

- If you sketch a cross-section, the properties for the cross-section include coordinates, turns, and related turn values, if applicable.

Place Volume Using Primitive Shapes

Places a volume in the model by selecting a pre-defined volume shape from a palette and then providing dimensional information to define the shape size. The list of volume shapes is obtained from the Equipment and Furnishings reference data for designed equipment and can be customized.

After the appropriate information is provided, the location of the space object in the model is controlled graphically by dragging the shape around the model. You can use existing tools such as the SmartSketch relationship indicators and **PinPoint** to position the shape. Each volume has an origin point as part of its definition, and the location of the volume is always relative to the active coordinate system.

Place Volume Using Primitive Shapes Ribbon

Sets options for placing a space object using a primitive shape. Primitive shapes are defined in the Equipment and Furnishings reference data for designed equipment.

Volume Properties

Displays the **Volume Properties** dialog box, which allows you to set properties for the volume that you are placing.

Name

Displays the default name for the space (as dictated by the active name rule), and allows you to type a different name, if needed.

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

⊘ **Enable Assoc Point Creation**

Specifies that the points of the volume are associative points, if the software detects constraints for the points. Associative points affect the behavior of the volume during modification such as movement or rotation.

⊗ **Disable Assoc Point Creation**

Specifies that the points of the volume are not associative points, even if the software finds constraints. You can click this button during or after volume placement. For example, during placement, you can use the default behavior at first (associative), and then click the non-associative option part-way through the construction process. When you specify the non-associative option, the software switches its behavior from associative to non-associative. The points that you created earlier retain their associativity.

NOTES

- To indicate that the volume has associative points, the **Enable Assoc Point Creation** button is indented on the ribbon ⊘⊗.

- To indicate that the volume has no associative points, the **Enable Assoc Point Creation** button is not indented on the ribbon, and the **Disable Assoc Point Creation** button is unavailable ⊘⊗.

- If multiple volumes are selected, the **Enable Assoc Point Creation** button is not displayed. However, if at least one associative point exists, the **Enable Assoc Point Creation** button displays on the ribbon 🖹 ⊗.

Break Association

Deletes the relationship between the volume and an object. Objects associated with a volume highlight when the volume is selected. This option is only available when modifying a selected volume that has an object associated with it.

How to Place a Volume using Primitive Shapes

1. Click **Place Volume Using Primitive Shapes** ⏚.

2. On the **Volume Properties** dialog box, select the volume type in the **Type** list.

   TIPS

   - The **Properties** dialog box title mirrors the volume type. For example, if you are placing an interference volume, the dialog box is titled **Interference Volume Properties**.

   - The last volume type used by **Place Volume Using Primitive Shapes** ⏚ displays as the default value. If this is the first time the command is being used, the type is user-defined.

3. On the **Shape** tab, select a shape in the **Shape** drop-down list.

4. Enter the dimensions of the shape.

5. Click **OK** to close the dialog box.

6. Type a name for the volume in the **Name** box.

7. Select a volume type from the **Type** list.

> 💡 TIP The list in the **Type** box provides only the last few types selected from the catalog. Choosing **More** displays the *Select System Dialog Box* (on page 20), which allows you to select any type of space found in the catalog database.

8. Select a folder from the **Space folder** list. Assigning volumes to a space folder organizes volumes. You can create additional folders with the *Create Space Folder* (on page 12) command.

9. To associate the points of the volume with points in the model, such as grid intersections, click **Enable Assoc Point Creation** ⊘. To drop the associative points during or after volume placement, click **Disable Assoc Point Creation** ⊗.

10. Click a location in the model to place the volume.

Associate Volume to Object

Establishes a relationship between an object and a volume in the model. An example is associating an interference volume with a particular pump so that when the pump is moved, the interference volume is also moved.

The relationship provides the following behaviors:

- If the related object moves or rotates, the space moves or rotates by the same transformation. The space size is not a function of the related object size.

- If the related object is copied or pasted, the space is also copied or pasted.

- If the space is copied or pasted, neither the related object nor the relationship is copied or pasted. You just get a new space.

- If the space is deleted, the relationship is deleted but not the related object.

You can view the properties of the relationship on the **Relationship** tab of the **Properties** dialog boxes for the related object and for the space.
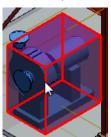
When you select a volume, any objects related to the select volume highlight.

What do you want to do?

Create a relationship between a volume and an object

1. Click **Associate Volume to Object** .
2. Select a space in the model.
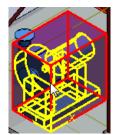
3. Select an object in the model. For example, you can select a pump.

📄 **NOTE** If you want to associate more than one space to an object, select the spaces before clicking **Associate Volume to Object** 🔧.

Delete a relationship between a volume and an object

1. Click **Select** ⬚ on the vertical toolbar.

2. Select a space in the model that has a relationship with an object.

3. Click **Break Association** 🔧 on the ribbon.

Place Drawing Volumes

Drawing volumes are an important part of the drawing generation process. You can create a drawing volume and associate it with a drawing volume component and drawing view using **Place Drawing Volume by View**, **Place Drawing Volume by Selection**, **Place Drawing Volume by Two Points**, or **Place Drawing Volume by Four Points**. Before using any of these commands, you must use the **Drawings and Reports** task to place a drawing view on a template.

All volumes are stored in the model. When you create a drawing volume, the software names the volume based on a name rule and places the volume in the space hierarchy. Alternatively, you can name the volume by typing user-defined text. Using the **Space** tab of the **Workspace Explorer**, you can locate and manipulate existing drawing volumes quickly and easily.

★ **IMPORTANT**

- If you delete a drawing volume in the model, the software deletes any associated drawings and drawing views.

- After you create a drawing volume, you cannot change its type.

In This Section

Place Drawing Volume by View

Creates a volume that is associated with a specific drawing volume component and a drawing view. This volume allows you to specify the objects to process in a drawing view. You can place more than one volume, which means that the software creates more than one drawing for the component.

The drawing view is specified when you edit a drawing template (with **Place Drawing View**) in the **Drawings and Reports** task. If the volume is larger than the drawing view in the template, it is clipped to fit the drawing view area. If the volume is smaller than the drawing view, the volume is centered within the drawing view area. For more information, see the *Orthographic Drawings User's Guide*, available from the **Help > Printable Guides** command in the software. You can use **PinPoint** , **Point Along** , and the SmartSketch relationship indicators to assist in positioning a volume.

★ **IMPORTANT** Before using this command, you must first use the **Drawings and Reports** task to create a drawing volume component with a single-view template. The view must have a defined scale (in other words, the scale property must NOT be set to **No Scale**). In addition, you must have the appropriate write permissions to modify the drawing view.
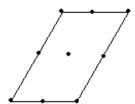
Place Drawing Volume by View Ribbon

Sets options for placing a drawing volume. Drawing views must be placed for drawing volume components before drawing volumes can be placed. The **Place Drawing Volume by View** command uses a volume component and its view as input to determine a volume's maximum size, orientation, and name.

Volume Properties

Displays the *Drawing Volume Properties Dialog Box* (on page 106), which allows you to set properties for the drawing volume.

First Depth Point

Places the first point of the volume. You can place multiple volumes. Each time that you start a new volume with a first point click, the software stores the previous volume in the model. Before placing the first depth point, you can use the left and right arrows on the keyboard to move the pointer to any of the nine points on the footprint. You must move the pointer away from and then back to the footprint to see the new location.

Second Depth Point

Places the second point of the volume. After you place the second depth point of a volume, you can place another volume.

Handles

Lets you drag the volume surface to a new location. This step is optional. When you select a volume surface, the current surface location is used as the "from" point. When the "to" point is selected, the surface is moved to a projection of the "to" point along an axis normal to the surface being moved.

Drawing Type

Displays a list of drawing volume components. You can define volume components in the Drawings and Reports task. Only those volume components to which you have access permissions higher than read-only appear for selection.

Drawing View

Displays a list of drawing views in the template for the volume component.
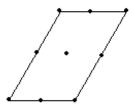
Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

How to Place Drawing Volume by View

1. Click **Place Drawing Volume by View** .

2. On the **Place Drawing Volume by View** ribbon, select a volume component and a drawing view in the **Drawing Type** and **Drawing View** boxes, respectively.

   TIPS

   ▪ By default, the last volume component used in the workspace appears in the **Drawing Type** ribbon box. Click **More** to display the *Select Volume Drawing Type Dialog Box* (on page 61).

   ▪ If you select a different volume component, the drawing view list updates to display the first view listed for that component. You can then select a different view.

3. Click to place the first depth point of the volume.

   TIP Before placing the first depth point, you can use the left and right arrows on the keyboard to move the pointer to any of the nine points on the footprint. You must move the pointer away from and then back to the footprint to see the new location.

4. Click to place the second depth point of the volume.

5. Click **Finish** to place the volume.

Place Drawing Volume by Selection

Generates a drawing volume around a selected set of objects in the model. If volumes are included in the select set, they will also be rendered in the final view. The software places drawing volumes in the space hierarchy, visible on the **Space** tab in the **Workspace Explorer**. You can place more than one volume, which means that the software creates more than one drawing for the component.

IMPORTANT Before using this command, you must first use the **Drawings and Reports** task to place a drawing view with any scale value, including **No Scale**. For more information about placing drawing views, see the *Orthographic Drawings User's Guide*, available from the **Help > Printable Guides** command in the software.

Place Drawing Volume by Selection Ribbon

Sets options for placing a drawing volume by selection. Drawing views must be placed for drawing volume components before drawing volumes can be placed. The **Place Drawing Volume by Selection** command uses an object range and a volume component as input to determine a volume's maximum size, orientation, and name.

Volume Properties

Displays the *Drawing Volume Properties Dialog Box* (on page 106), which allows you to set

properties for the drawing volume.

Handles

Allows you to adjust the size of the drawing volume by dragging its bounded planes. This option is not enabled until a drawing volume is placed in the model.

Finish

Displays the drawing volume in the active graphic view and returns to the **Place Drawing Volume by Selection** command.

Drawing Type

Displays a list of drawing volume components. You can define volume components in the **Drawings and Reports** task. Only those volume components to which you have access permissions higher than read-only appear for selection.

How to Place a Drawing Volume by Selection

1. Click **Place Drawing Volume by Selection** .

2. Select the objects that you want enclosed in the drawing volume.

3. On the **Place Drawing Volume by Selection** ribbon, select a drawing volume component in the **Drawing Type** box.

    TIP By default, the last component used in the workspace appears in the ribbon box. Click **More** to display the *Select Volume Drawing Type Dialog Box* (on page 61).

4. Click **Finish** to place the volume.

Select Volume Drawing Type Dialog Box

Selects a drawing volume component. This dialog box appears when you select **More** in the **Drawing Type** box on the horizontal ribbon. Only those components to which you have access permissions higher than read-only appear for selection. After you select a component, the software returns you to the model, where you can finalize configuration and placement of the drawing volume.

Place Drawing Volume by Two Points

 Creates a volume that is associated with a specific drawing volume component by using two points to represent opposite vertices of the volume. The two points can be located with standard tools, such as **PinPoint** or SmartSketch relationship indicators. You can place more than one volume, which means that the software creates more than one drawing for the drawing volume component.

The software places drawing volumes in the space hierarchy, visible on the **Space** tab in the **Workspace Explorer**.

 IMPORTANT Before using this command, you must first use the **Drawings and Reports** task to place a drawing view with any scale value, including **No Scale**. For more information about placing drawing views, see the *Orthographic Drawings User's Guide*, available from the **Help > Printable Guides** command in the software.
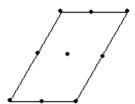
Place Drawing Volume by Two Points Ribbon

Sets options for placing a drawing volume. Drawing views must be placed for drawing volume components before drawing volumes can be placed. The **Place Drawing Volume by Two Points** command uses a volume component and its view as input to determine a volume's maximum size, orientation, and name.

Volume Properties

Displays the *Drawing Volume Properties Dialog Box* (on page 106), which allows you to set properties for the drawing volume.

First Depth Point

Places the first point of the volume. You can place multiple volumes. Each time that you start a new volume with a first point click, the software stores the previous volume in the model. Before placing the first depth point, you can use the left and right arrows on the keyboard to move the pointer to any of the nine points on the footprint. You must move the pointer away from and then back to the footprint to see the new location.

Second Depth Point

Places the second point of the volume. After you place the second depth point of a volume, you can place another volume.

Handles

Lets you drag the volume surface to a new location. This step is optional. When you select a volume surface, the current surface location is used as the "from" point. When the "to" point is selected, the surface is moved to a projection of the "to" point along an axis normal to the surface being moved.

Drawing Type

Displays a list of drawing volume components. You can define volume components in the **Drawings and Reports** task. Only those volume components to which you have access permissions higher than read-only appear for selection.

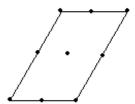**Drawing View**

Displays a list of drawing views in the template for the volume component.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

How to Place Drawing Volumes by Two Points

1. Click **Place Drawing Volume by Two Points** .

2. On the **Place Drawing Volume by Two Points** ribbon, select a drawing volume component and a drawing view in the **Drawing Type** and **Drawing View** boxes, respectively.

3. Click to place the first depth point of the volume.

   TIP Before placing the first depth point, you can use the left and right arrows on the keyboard to move the pointer to any of the nine points on the footprint. You must move the pointer away from and then back to the footprint to see the new location.

4. Click to place the second depth point of the volume.

Place Drawing Volume by Four Points

 Creates a volume that is associated with a specific drawing volume component by using three points to define a base plane and a fourth point to define elevation or depth. By selecting the three planar points in the plan view, you can ensure that the volume is parallel to the base elevation plane of your design. You can use **PinPoint** , **Point Along** , and the SmartSketch relationship indicators to assist defining the points. You can place more than one volume, which means that the software creates more than one drawing for the component.

★ IMPORTANT Before using this command, you must first use the **Drawings and Reports** task to create a drawing volume component. For more information about placing drawing views, see the *Orthographic Drawings User's Guide*, available from the **Help > Printable Guides** command in the software.

Place Drawing Volume by Four Points Ribbon

Sets options for placing a drawing volume. Drawing views must be placed for drawing volume components before drawing volumes can be placed. The **Place Drawing Volume by Four Points** command uses a component and its view as input to determine a volume's maximum size, orientation, and name.

 Volume Properties

Displays the *Drawing Volume Properties Dialog Box* (on page 106), which allows you to set properties for the drawing volume.
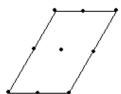
 Lock Plan Plane

Locks the second and third points on the plane as determined by the Z-elevation of the first point, thereby allowing you to place the first three volume points in the same elevation plane. You can disable the lock to place a volume with a bottom face that is not flat.

First Point

Places the first point of the drawing volume. You can place multiple volumes. Each time that you start a new volume with a first point click, the software stores the previous volume in the model. Before placing the first point, you can use the left and right arrows on the keyboard to move the pointer to any of the nine points on the footprint. You must move the pointer away from and then back to the footprint to see the new location.

Second Point

Places the second point of the volume. This point determines the length of the drawing volume along the X-axis.

Third Point

Defines the third point for the volume. This point defines a plane and determines the length of the drawing volume along the Y-axis.

Fourth Point

Sets the elevation of the new drawing volume along the Z-axis. After you place the fourth point of the drawing volume, you can continue to define points to place additional volumes.
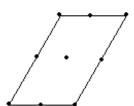
Drawing Type

Displays a list of drawing volume components. You can define volume components in the **Drawings and Reports task**. Only those volume components to which you have access permissions higher than read-only appear for selection.

How to Place Drawing Volumes by Four Points

1. Click **Place Drawing Volume by Four Points** .

2. On the **Place Drawing Volume by Four Points** ribbon, select a volume component in the **Drawing Type** box.

3. In the model, supply three points to define the drawing volume face.

   TIP Before placing the first depth point, you can use the left and right arrows on the keyboard to move the pointer to any of the nine points on the footprint. You must move the pointer away from and then back to the footprint to see the new location.

4. Supply a fourth point to define the depth of the drawing volume.

Modify Space Objects

After creating space objects, you can modify or delete them.

Modifying Volumes

In general, you can move a volume's location in the model and change the placement points and faces of a volume. In some cases, movement and rotation can cause distortion in the volume's shape. When the points of the volume are associated to points in the model, such as grid intersections, it might not be possible to move or rotate the volume. You can drop the associative points of many types of volumes. Then you can move, rotate, and change the size and dimensions of the volume.

When you edit a space volume using **PinPoint** with relative tracking on, the software sets the **PinPoint** origin to the location of the selected handle. For volumes created using **Place Volume by Two Points** command, you can modify the common faces between the volumes using **Handles** or by typing the **Offset** value.

Deleting Volumes

You can delete volumes and other related objects. In some cases, deleting an object causes other objects to be deleted. For example, when you delete a drawing volume, the associated views are deleted.

Object status and your permissions affect whether or not you can modify or delete an object. A volume that is set to **Approved** cannot be modified or deleted. However, you may be able to modify or delete a volume that is set to **Working**.

Edit Volume Ribbon

Sets options for modifying a volume that has been placed in the model. This ribbon appears when you select a volume.

Volume Properties

Displays the **Volume Properties** dialog box, which allows you to set properties for the volume.

Volume Point 1

Specifies that you are selecting the first point for the definition of the volume.

Volume Point 2

Specifies that you are selecting the second point for the definition of the volume.

★ IMPORTANT If the selected volume was placed using the **Place Volume by Four Points** command, the ribbon also displays **Volume Point 3** and **Volume Point 4** buttons.

Handles

Allows you to adjust the size of the selected space object by dragging its bounded planes.

If you try to modify a volume using handles and that volume is constrained, the software displays a message asking if you want to remove the constraint and continue modification. You can constrain volumes by specifying keypoints, such as grid intersections, during volume placement.

Name

Displays the default name for the space (as dictated by the active name rule) and allows you to type a different name, if needed.

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

Space folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

Edit Path Straight Segment Ribbon

Sets options for modifying a straight segment of an existing path. This ribbon appears when you select a straight segment in the existing path.

Properties

Displays the **Sketch Properties** dialog box, which allows you to view properties for the path.

Finish Path

Displays the path in the active graphic view and returns you to the **Place Volume Along Path** command.

Cancel

Cancels the changes that you have made and returns you to the model.

Show Cross Section View

Opens a new window that is oriented to display the sketch (cross-section) plane as viewed from the end of the first path segment. The option is only available when the cross-sectional type is defined as **Sketch**.

Edit

Allows you to modify and move the existing path. You can select a segment, a turn, or multiple segments to which you want to make modifications.

Create

Displays the **Create Path** ribbon to allow you to add segments to an existing path.

First Point

Specifies that you are selecting the starting location of the move vector.

Second Point

Specifies that you are selecting the ending location of the move vector.

Path Type

Specifies the type of line for the current segment in the path. To change the segment type, click a different type in the **Path Type** list.

- **Line** - Specifies a straight line for the segment.

- **Arc by 3 Points** - Specifies an arc by three points for the segment. The first point is the start of the arc, the second point is a point on the arc, and the third point is the end of the arc.

- **No Line** - Specifies that you do not want the current segment of the path to have a line associated with it.

- **Arc by End Points** - Specifies an arc by end points for the segment. The first point you click is the start of the arc; the second point you click is the end of the arc; the third point you click defines the plane, radius, and sweep angle of the arc.

- **Elliptical Arc** - Specifies an elliptical arc for the segment. The first point you click is the start of the arc; the second point you click is the center of the ellipse; the third point you click defines the minor/major axis ratio and the sweep angle.

Plane

Activates options for selecting a working plane for the path.

- **Plan Plane** - Defines the work surface as the XY plane. You can also press CTRL+1 to select this option.

- **Z Plane: X-West / Elevation Plane: East-West** - Defines the work surface as the XZ plane. You can also press CTRL+2 to select this option.

- **Section Plane: Y- South / Elevation Plane: North-South** - Defines the work surface as the YZ plane. You can also press CTRL+3 to select this option.

- **Plane by Turn** - Defines the work surface as the plane defined by an existing turn. You select the turn to set the plane. You can also press CTRL+4 to select this option.

- **Plane by Three Points** - Defines the work surface using three points you define. You can also press CTRL+5 to select this option.

- **No Plane** - Clears any work surfaces. The software does not project points that you place to any plane. You can also press CTRL+6 to select this option.

Delete Selected Items

Deletes the selected path segments.

Length Locked

Defines whether or not the length of the selected segment should remain constant while moving.

When locked , the software automatically modifies the turn points, along with the length and angle of adjacent segment, to remain connected to the moved segment. The length of

the moved segment does not change.

When not locked 🔧, the software extends or shortens the associated segments to connect with the new position of the moved segment. The length of the moved segment can change.

Edit Path Arc Ribbon

Sets options for modifying an arc that is part of an existing path. This ribbon appears when you select an arc in the existing path.

Properties

Displays the **Sketch Properties** dialog box, which allows you to view properties for the path.

Finish Path

Displays the path in the active graphic view and returns you to the **Place Volume Along Path** command.

Cancel

Cancels the changes that you have made and returns you to the model.

Show Cross Section View

Opens a new window that is oriented to display the sketch (cross-section) plane as viewed from the end of the first path segment. The option is only available when the cross-sectional type is defined as **Sketch**.

Edit

Allows you to modify and move the existing path. You can select a segment, a turn, or multiple segments to which you want to make modifications.

Create

Displays the **Create Path** ribbon to allow you to add segments to an existing path.

First Point

Specifies that you are selecting the starting location of the move vector.

Second Point

Specifies that you are selecting the ending location of the move vector.

Path Type

Specifies the type of line for the current segment in the path. To change the segment type, click a different type in the **Path Type** list. You can select from the following line types:

- **Line** - Specifies a straight line for the segment.

- **Arc by 3 Points** - Specifies an arc by three points for the segment. The first point is the start of the arc, the second point is a point on the arc, and the third point is the end of the arc.

- **No Line** - Specifies that you do not want the current segment of the path to have a line associated with it.

- **Arc by End Points** - Specifies an arc by end points for the segment. The first point you click is the start of the arc; the second point you click is the end of the arc; the third point you click defines the plane, radius, and sweep angle of the arc.

- ▪ ○ **Elliptical Arc** - Specifies an elliptical arc for the segment. The first point you click is the start of the arc; the second point you click is the center of the ellipse; the third point you click defines the minor/major axis ratio and the sweep angle.

Plane

Activates options for selecting a working plane for the path. Six options are available:

- ▪ ◇ **Plan Plane** - Defines the work surface as the XY plane. You can also press CTRL+1 to select this option.

- ▪ ◪ **Z Plane: X-West / Elevation Plane: East-West** - Defines the work surface as the XZ plane. You can also press CTRL+2 to select this option.

- ▪ ◫ **Section Plane: Y- South / Elevation Plane: North-South** - Defines the work surface as the YZ plane. You can also press CTRL+3 to select this option.

- ▪ ◨ **Plane by Turn** - Defines the work surface as the plane defined by an existing turn. You select the turn to set the plane. You can also press CTRL+4 to select this option.

- ▪ ▷ **Plane by Three Points** - Defines the work surface using three points you define. You can also press CTRL+5 to select this option.

- ▪ ✕ **No Plane** - Clears any work surfaces. The software does not project points that you place to any plane. You can also press CTRL+6 to select this option.

✕ Delete Selected Items

Deletes the selected path segments.

Edit Path Turn Ribbon

Sets options for modifying a turn in an existing path. This ribbon appears when you select a turn in the existing path.

▤ Properties

Displays the **Sketch Properties** dialog box, which allows you to view properties for the path.

Finish Path

Displays the path in the active view and returns to the **Place Volume Along Path** command.

Cancel

Cancels the changes you have made and returns you to the model.

▣ Show Cross Section View

Opens up a new window that is oriented to display the sketch (cross-section) plane as viewed from the end of the first path segment. The option is only available when the cross-sectional type is defined as **Sketch**.

Edit

Allows you to modify and move the existing path. You can select a segment, a turn, or multiple segments to which you want to make modifications.

Create

Displays the **Create Path** ribbon to allow you to add segments to an existing path.

First Point

Specifies that you are selecting the starting location of the move vector.

Second Point

Specifies that you are selecting the ending location of the move vector.

Plane

Activates options for selecting a working plane for the path. Six options are available:

- **Plan Plane** - Defines the work surface as the XY plane. You can also press CTRL+1 to select this option.

- **Z Plane: X-West / Elevation Plane: East-West** - Defines the work surface as the XZ plane. You can also press CTRL+2 to select this option.

- **Section Plane: Y- South / Elevation Plane: North-South** - Defines the work surface as the YZ plane. You can also press CTRL+3 to select this option.

- **Plane by Turn** - Defines the work surface as the plane defined by an existing turn. You select the turn to set the plane. You can also press CTRL+4 to select this option.

- **Plane by Three Points** - Defines the work surface using three points you define. You can also press CTRL+5 to select this option.

- **No Plane** - Clears any work surfaces. The software does not project points that you place to any plane. You can also press CTRL+6 to select this option.

Delete Selected Items

Deletes the selected path segments.

Angle 1

Displays the first angle used in the turn, if one exists. This option is read-only.

Angle 2

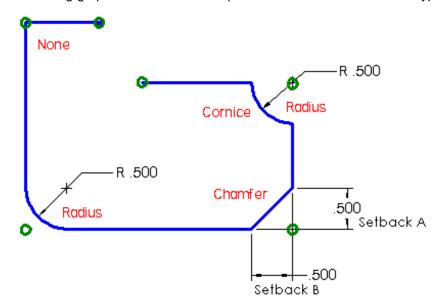Displays the second angle used in the turn, if one exists. This option is read-only.

Angle 3

Displays the third angle used in the turn, if one exists. This option is read-only.

Turn Type

Specifies the type of turn. You can change the turn type by selecting another type in the list.

- **None** - Indicates that no special turn type is applied to the turn.

- **Bend** - Specifies that the turn type between two segments is a bend. You can specify the angle of the bend in the **Value** box.

- **Cornice** - Specifies that the turn type between two segments is a cornice. You can specify the radius of the cornice in the **Value** box.

- **Chamfer** - Specifies that the turn type between two segments is a chamfer. You can specify the dimensions for setback A and setback B of the chamfer in the **Value** box. The dimensions of setback A and setback B for the chamfer must be the same.

The following graphic includes an example of each of the available turn types:

Value

Defines dimensions for the selected turn type.

Edit Multiple Volumes Ribbon

Sets options for modifying the common face for multiple volumes that are created using **Place Volume by Two Points** command. This ribbon appears when you select multiple volumes.

Displays the **Volume Properties** dialog box, which allows you to set properties for the volume.

Specifies that the points of the volume are not associative points, even if the software finds constraints. You can click this button during or after volume placement. For example, during placement, you can use the default behavior at first (associative), and then click the non-associative option part-way through the construction process. When you specify the non-associative option, the software switches its behavior from associative to non-associative. The points that you created earlier retain their associativity.

Deletes the relationship between the volume and an object. Objects associated with a volume highlight when the volume is selected. This option is only available when modifying a selected volume that has an object associated with it.

Allows you to adjust the size of the selected space object by dragging its bounded planes. This option is enabled when the selected volumes have common faces.

Offset

Specifies the offset values to modify the common face of the object. This option is enabled when the selected volumes have common faces.

What do you want to do?

- *Edit volume properties* (on page 72)
- *Modify the placement points of a volume* (on page 73)

- *Modify the volume size by dragging* (on page 73)

- *Modify cross-sectional properties for a volume* (on page 75)

- *Modify a straight segment in a path* (on page 75)

- *Move segments of a path* (on page 76)

- *Add segments to a path* (on page 77)

- *Modify an arc in a path* (on page 77)

- *Modify a turn in a path* (on page 78)

- *Move a volume to a new location* (on page 78)

- *Modify a sketched cross-section* (on page 79)

- *Modify the common face for multiple volumes* (on page 80)

- *Convert a standard cross-section to a sketch* (on page 81)

- *Delete a space object* (on page 81)

Edit volume properties

1. On the vertical toolbar, click **Select** .

2. In the model or on the **Space** tab in the **Workspace Explorer**, click the space object with the properties that you want to edit.

3. Click **Edit > Properties**.

4. On the *Properties Dialog Box* (on page 94), click the **General** tab to edit general information about the selected object:

   - To edit the name, type a different name in the **Name** box.

   - To change the type of volume, select a different type in the **Type** list. The **Class** box updates automatically based on the type that you select in the **Type** list.

   - For drawing volumes, you can specify the type of volume during creation of the volume, but not after creation of the volume.

5. To edit the location, select a different space folder in the **Space folder** list.

NOTES You can also modify the properties on the horizontal ribbon that appears when you select the object.

Modify the placement points of a volume

1. On the vertical toolbar, click **Select** ⌖.

2. In the model or on the **Space** tab in the **Workspace Explorer**, select the space object with the placement points that you want to edit.

3. On the **Edit Volume** ribbon, click **Volume Point 1** ⬚.

   The software prompts you to type the first point for the definition of the selected space object.
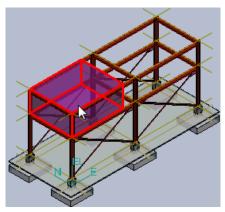
4. Click **Volume Point 2** ⬚.

   The software prompts you to type the second point for the definition of the selected space object.

5. Right-click to end the command.
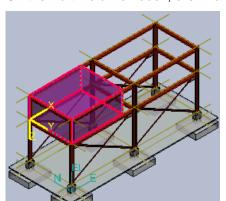
   ▤ **NOTE** After the volume is placed in the new location, you can continue to use the **Edit Volume** ribbon to modify properties of the selected volume. A right-click ends editing mode.

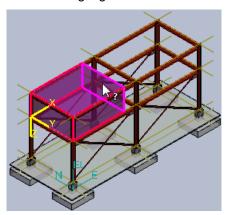# Modify the volume size by dragging

1. On the vertical toolbar, click **Select** ⌖.

2. In the model or on the **Space** tab in the **Workspace Explorer**, select a volume object.
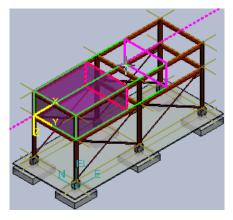
3. On the **Edit Volume** ribbon, click **Handles** ⊡ .

4. As you move the mouse over the selected object, the corresponding bounded plane or surface is highlighted. Click to select the plane that you want to move.
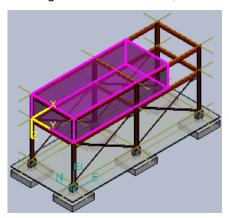

The Select cursor changes to a crosshair.

5. As you drag your mouse, the selected surface moves to increase or decrease the object size.

6. Click again to end the move, and set the new volume size.

Modify cross-sectional properties for a volume

1. Click **Select** .

2. Select the volume for which you want to modify the cross-section.

   NOTE You can modify the volume's cross-section only if you created that volume using **Place Volume Along Path** .

3. Click **Cross-Section** □ on the ribbon.

4. On the *Properties Dialog Box* (on page 94), click the **Cross-Section** tab.

5. Make modifications to the cross-sectional properties.

6. Click **OK** to apply the changes to the cross-section.

   NOTE You cannot modify the properties of a sketched cross-section on the **Volume Properties** dialog box. Instead, you must make changes to the path that defines the cross-sectional sketch. For more information, see *Modify a Sketched Cross-section* (on page 79).

Modify a straight segment in a path

1. Click **Select** .

2. Select the volume for which you want to modify the path.

   NOTE You can modify the volume's path only if you created that volume using **Place Volume Along Path** .

3. Click **Path** .

   The software displays the path in yellow.

4. Select the straight segment that you want to modify.

5. To change the line type for the segment, click a new type in the **Path Type** list.

6. To change the plane for the segment, click a new plane in the **Plane** list.

7. To delete the segment, click **Delete** ✕.

8. If you want the length of a straight segment to remain constant when you move the segment, click **Length Locked** 🔺.

   ### 💡 TIPS

   ▪ When the segment length is locked, the software automatically modifies the turn points, along with the length and angle of the adjacent segment, to remain connected to the moved segment. The length of the moved segment does not change.

   ▪ When the segment length is not locked, the software extends or shortens the associated segments to connect with the new position of the moved segment. The length of the moved segment can change.

9. Click **Finish** to accept the path changes.

10. Click **Finish** to modify the volume.

📄 NOTE You can also move the segments of a path. For more information, see *Move Segments of a Path* (on page 76).

Move segments of a path

1. Click **Select** 🔩.

2. Select the volume for which you want to modify the path.

   📄 NOTE You can modify the volume's path only if you created that volume using **Place Volume Along Path** 📷.

3. Click **Path** ⇄.

   The software displays the path in yellow.

4. Select the segments that you want to move.

5. If you want the length of a straight segment to remain constant while you move the segment, click **Length Locked** 🔺.

   ### 💡 TIPS

   ▪ When the segment length is locked, the software automatically modifies the turn points, along with the length and angle of the adjacent segment, to remain connected to the moved segment. The length of the moved segment does not change.

   ▪ When the segment length is not locked, the software extends or shortens the associated segments to connect with the new position of the moved segment. The length of the moved segment can change.

6. Click to specify the starting location of the move vector.

7. Click to specify the ending location of the move vector.

8. Click **Finish** to accept the path changes.

9. Click **Finish** to modify the volume.

Add segments to a path

1. Click **Select** .

2. Select the volume for which you want to modify the path.

    NOTE You can modify the volume's path only if you created that volume using **Place Volume Along Path** .

3. Click **Path** .

    The software displays the path in yellow.

4. To add one or more segments to the path, click **Create**.

5. Click the point on the existing path where you want to insert the new segment.

    TIPS

    - You can use **PinPoint** , **Point Along** , and the SmartSketch relationship indicators when defining your path.

    - You can change the plane for the path by selecting a different plane in the **Plane** list.

    - To change the segment from a straight line to an arc, click **Arc by 3 Points** in the **Path Type** list, and then click three points to define the arc.

    - To switch back to a straight line after sketching an arc, click **Line** in the **Path Type** list.

    - To break the path, click **No Line** in the **Path Type** list.

6. Click to place other points and add to the path as needed.

    TIP To change the turn type for the corner, click a different turn type in the **Turn Type** list, and define the dimensions for the turn in the **Value** box.

7. Click **Finish** to accept the path changes.

8. Click **Finish** to modify the volume.

Modify an arc in a path

1. Click **Select** .

2. Select the volume for which you want to modify the path.

    NOTE You can modify the volume's path only if you created that volume using **Place Volume Along Path** .

3. Click **Path** .

    The software displays the path in yellow.

4. Select the arc that you want to modify.

5. To change the line type for the segment, click a different type in the **Path Type** list.

6. To change the plane for the segment, click a different plane in the **Plane** list.

7. To delete the segment, click **Delete** ✕.

8. Click **Finish** to accept the path changes.

9. Click **Finish** to modify the volume.

📝 **NOTE** You can also move the segments of a path. For more information, see *Move Segments of a Path* (on page 76).

Modify a turn in a path

1. Click **Select** ⬚.

2. Select the volume for which you want to modify the path.

   📝 **NOTE** You can modify the volume's path only if you created that volume using **Place Volume Along Path** 🔲.

3. On the ribbon, click **Path** ⟨.

   The software displays the path in yellow.

4. Select the turn that you want to modify.

5. To change the plane for the turn, click a different plane in the **Plane** list.

6. To delete the turn, click **Delete** ✕.

7. To change the turn type, select a different type in the **Turn Type** list.

8. To change the dimensions for the selected turn type, type a value in the **Value** box.

9. Click **Finish** to accept the path changes.

10. Click **Finish** to modify the volume.

📝 **NOTE** You can also move the segments of a path. For more information, see *Move Segments of a Path* (on page 76).

Move a volume to a new location

1. Click **Select** ⬚.

2. In the model or on the **Space** tab in the **Workspace Explorer**, select the volume that you want to move.

3. Click **Edit > Move**.

   The software prompts you to indicate the origination (or from) location.

4. Select the origination location of the volume.

   The software prompts you to indicate the destination (or to) location of the volume that you want to move.

5. Click the destination location for the volume that you want to move.

6. Right-click to end the command.

⊟ NOTE To start the **Move** command, you can also click **Move** ⊕ on the horizontal toolbar; however, the edit ribbon does not appear and no other modifications to the volume can be performed until after the move is complete.

Modify a sketched cross-section

1. Click **Select** ⊿.

2. Select the volume for which you want to modify the sketched cross-section.

3. Click **Cross-Section** ▱.

   The software displays the cross-sectional path in yellow.

4. Click **Show Cross-Section View** ⊡ to display the sketched cross-section in a new window.

   A new window opens that is oriented to display the sketch (cross-section) plane as seen from the end of the first path segment.

5. If you want to modify a straight segment, select the segment that you want to modify, and then make changes on the **Edit Path Straight Segment** ribbon.

   Modify a Straight Segment in a Path (on page 75)

6. If you want to modify an arc, select the arc that you want to modify, and then make changes on the **Edit Path Arc** ribbon.

   Modify an Arc in a Path (on page 77)

7. If you want to modify a turn, select the turn that you want to modify, and then make changes on the **Edit Path Turn** ribbon.

   Modify a Turn in a Path (on page 78)

8. If you want to move a segment, click the segment that you want to move, and then click the point from which you want to move the segment and the point to which you want to move the segment.

   Move Segments of a Path (on page 76)

9. If you want to add segments to the path, click **Create** on the ribbon, and then click to place the new segments.

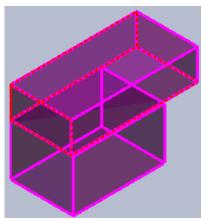   *Add Segments to a Path* (on page 77)

   ♥ TIP You can add as many segments to the cross-sectional path as you need. However, you must close the cross-sectional path to be able to save the cross-sectional path.

10. If you want to delete a segment, select the segment that you want to delete, and then click **Delete** ✕.

11. Click **Finish** to accept the path changes.

12. Click **Finish** to modify the volume.

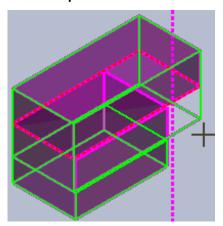# Modify the common face for multiple volumes

1. Click **Select** ⬚.

2. Select two or more volumes that have a common face.

3. On the **Edit Multiple Volumes** ribbon, click **Handles** 🔳 .

   The common faces of the volume selected first are displayed by the dotted lines.

4. Select the common face.

5. Modify the common face by moving the mouse. You can also type the **Offset** value in the **Edit Multiple Volumes** ribbon.

Convert a standard cross-section to a sketch

1. Click **Select** ⤵.

2. Select the volume for which you want to modify the cross-section.

    ⊟ **NOTE** You can modify the volume's cross-section only if you created that volume using **Place Volume Along Path** ⌗.

3. Click **Cross-Section** ▭ to display the **Properties** dialog box.

4. On the **Cross-Section** tab, select **Sketch** in the **Cross-Section** list.

5. Click **OK**.

    ● **TIP** The standard cross-section is converted to a sketched cross-section. The shape of the original cross-section is broken down into the segments and points that define the path of the cross-section. You can modify these segments to customize the cross-section.

6. Make modifications to the sketched cross-section as needed.

    Modify a Sketched Cross-Section (on page 79)

7. Click **Finish** on the **Place Volume Along Path** ribbon to save the changes to the volume.

⊟ **NOTES**

- When you convert a standard cross-section to a sketch, the properties for the sketched cross-section include the coordinates, the turn type, and values for each point that define the cross-sectional path.

- You cannot modify the properties of a sketched cross-section on the **Volume Properties** dialog box. Instead, you must make changes to the path that defines the cross-sectional sketch.

Delete a space object

1. Click **Select** ⤵.

2. Click the **Space** tab in the **Workspace Explorer**.

3. Click the space object that you want to remove.

4. Click **Edit > Delete**.

    ● **TIP** You can also click **Delete** ✕ on the horizontal toolbar.

⊟ **NOTES**

- **Delete** ✕ propagates down the hierarchy. For example, if you delete a space folder, its children (if any) and all the volumes contained in the folder are deleted as well.

- If you delete a drawing volume in the model, the software deletes any associated drawings and drawing views.

- Deleting a merged volume deletes all of the sub-volumes associated with it.

- Deleting a volume bound by spaces deletes the individual integrity of the sub-volumes, but does not delete the sub-volumes themselves.

Assign Design Parent to Compartments and Volumes

Tools > **Assign Design Parent** allows you to specify the design parent or space parent for compartments and volumes.

Assign Design Parent Ribbon

🔲 **Select Volume**

Allows you to select volumes and compartments, using the **Workspace Explorer** or the graphic view.

Space Parent

Specifies a space folder to use as the space parent of the selected compartments and volumes. Click **More...** to open the **Select Space Folder** dialog box. For more information, see *Select Space Folder Dialog Box in the Smart 3D Compartmentation User's Guide.*

Design Parent

Specifies a design equipment folder to use as the design parent of the selected compartments and volumes. Click **More...** to open the **Select System** dialog box. For more information, see *Select System Dialog Box* in the *Smart 3D Common User's Guide*.

Finish

Assigns the selected compartments and volumes to the selected folders.

Assign a space and design parent to compartments and volumes

1. Click **Tools > Add Design Parent**.

    *The **Add Design Parent** ribbon bar displays.*

2. Click **Select Volume** 🔲, and then select the compartments and volumes from the **Workspace Explorer** or from the graphic view.

3. Under **Space Parent**, select the space folder to use as the space parent.

4. Under **Design Parent**, select the design equipment folder to use as the design parent.

    📝 **NOTE** The design parent must be a design equipment folder.

5. Click **Finish**.

Query Service Command

Provides queries on compartments, space volumes, and blocks. These queries are related to volumes, objects, and geometry. You can export volume and object query results to an .xls or .pdf file. You can save a .sat or .iges file from the geometry queries. Select **Tools > Query Service** to run this command. The queries fall into the following categories:

- Volumes
- Objects
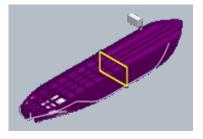- Geometry
- Custom Query
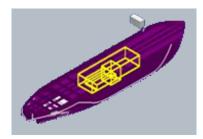
You specify the type of query on the ribbon for this command.

Volume Queries

You can query on compartments, space volumes, and blocks in the model. This type of query is useful, for example, if you want to identify any combination of compartments, space volumes, and blocks that are on or cross a deck or plane.

The following table shows a volume query to identify all compartments that cross a plate:

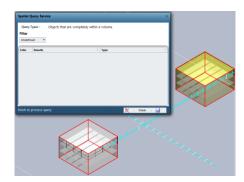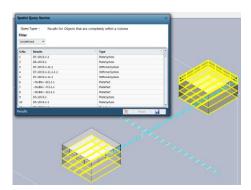**Input**   **Output**

Object Queries

These queries allow you to find objects that are fully and partially within a spatial volume.

The following table shows an object query to identify all objects completely within a spatial volume:
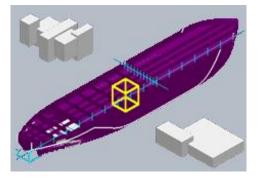
Input

Output

Geometry Queries

Examples of geometry queries include: finding bounded plates, creating a collection of the faces of a compartment, computing the area and properties of a plane intersecting a compartment, computing the overlap and adjacency between two compartments, and finding the range of a compartment.
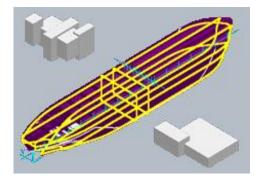
An added benefit of the geometry queries is that you can save a .sat or .iges file of the query results.

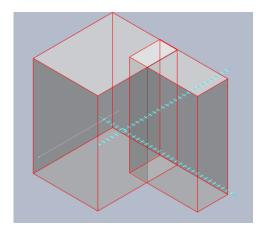The following table shows a geometry query to find topological boundaries (bounded plates).

Input

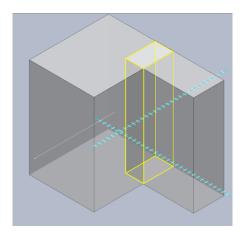

Output

The following table shows a geometry query to find the overlap geometry between adjacent volumes:

Input	Output

Custom Query

Runs customized queries on spatial volumes, objects, and geometry. The **Query Service (Custom Query)** ribbon displays options for running customized queries.

Query Service Ribbon

Displays options for running queries on compartments, objects, geometry, and loads.

Query Types

Choose the overall type of query. You can choose from **Volumes**, **Objects**, **Geometry**, or **Custom Query**. Selecting **Custom Query** opens the **Query Service (Custom Query)** ribbon, so that you can specify more options.

Result Type

Specifies the types of objects that you want the query to examine. You can choose from any combination of objects, compartments, or spaces.

✕ Reject

Rejects the selected workspace filter objects.

Finish

Generates and displays the query results.

💾 Save

Saves results of a geometry query to a .pdf, .xls, .sat, or .iges file.

Query Service (Custom Query) Ribbon

Displays options for running customized queries on compartments. This ribbon displays when you select **Custom Query** in the **Query Type** box on the **Query Service** ribbon.

Result Type

Specifies the types of objects that you want the query to examine. You can choose from all objects, compartments, or spaces.

Filter

Specifies a filter to control the results of the query. Click **More** to display the **Select Filter** dialog box.

Direction

Describes the direction relative to the ship.

Query Criteria

Describes the select criteria. For example, the selected criteria can be inside, outside, or overlapping the space volume.

Compart Query Required

Processes the query data with respect to the construction knowledge available to the input object.

✗ Reject

Rejects the selected workspace filter objects.

Finish

Generates the query results.

💾 Save

Saves results of a geometry query to a .pdf, .xls, .sat, or .iges file.

Add To Select Set

Adds the query results to the select set.

What do you want to do?

- *Run a spatial query* (on page)
- *Run a custom query* (on page)

Run a spatial query

1. Click **Tools** > **Query Service**.

   *The **Query Service** ribbon and dialog box display.*

2. On the **Query Service** ribbon, select a type of query in the **Query Types** box.

3. Set **Result Type** to the types of objects to query.

4. Select objects in a graphic view or in the **Workspace Explorer**.

   💡 TIP The message in the status bar indicates the type of object to select.

5. Click **Finish**.

   *The query results display in the **Query Service** dialog box.*

NOTES

- You can select the results in the **Query Service** dialog box to highlight the corresponding object in red in the graphic view.

- For a geometry query, click **Save** 💾 to save the results to a .sat or .iges file.

Run a custom query

1. Click **Tools** > **Query Service**.

   *The **Query Service** ribbon and dialog box display.*

2. On the **Query Service** ribbon, set **Query Type** to **Custom Query**.

   *The **Query Service (Custom Query)** ribbon displays.*

3. Under **Result Type**, select the type of objects to query.

4. Select objects in a graphic view or in the **Workspace Explorer**.

   TIP The message in the status bar indicates the type of object to select.

5. Specify the other ribbon properties as necessary to define the query.

6. Click **Finish**.

   *The query results display in the **Query Service** dialog box.*

NOTES

- You can select the results in the **Query Service** dialog box to highlight the corresponding object in red in the graphic view.

- For a geometry query, click **Save** 💾 to save the results to a .sat file.

Query Service Dialog Box

Displays the results of the query you ran. This dialog box appears when you click **Tools > Query Service**.

Query Types

Specifies what is being queried. The following types of queries are available:

Volumes

Volumes on a deck - Reports volumes that are on the input deck plate.

Volumes cross a deck - Reports volumes that cross the input deck plate.

Volumes on or cross a deck - Reports volumes that either cross or are on the input deck plate.

Volumes on a plane - Reports volumes that are on the input plane.

Volumes crossing a plane - Reports volumes that cross the input plane.

Volumes on or crossing a plane - Reports volumes that either cross or are on the

input plane.

Volumes by Part - Reports volumes by the input volume part name.

Volumes by PartClass - Reports volumes by the input volume part class.

Volume based on point in model - Reports volumes on the given input point.

Volumes connected (get adjacent Volumes) - Reports volumes that are adjacent to the input volume.

Volumes connected on the same deck or plane - Reports volumes that are connected on the input deck plate or plane.

Objects

Objects that are completely within a Volume - Reports objects that are completely inside the input volume.

Objects that cross a Volume - Reports objects that cross the input volume.

Objects that are Inside and Touching a Volume - Reports objects that are completely inside and touching the input volume.

Objects that are Outside and Touching a Volume - Reports objects that are completely outside and touching the input volume.

Objects that are Outside a Volume - Reports objects that are outside the input volume.

Objects Encompass and Touching a Volume - Reports objects that are encompassed within and touching the input volume.

Objects Encompass and within a Volume - Reports objects that are encompassed within the input volume.

Objects whose center point is within a Volume - Reports objects whose center point is within the input volume.

Geometry

Specify Volume topological boundaries (get bounded plates) - Reports topological boundaries (bounded plates) for the input volume.

Get the Volume Geometry - Retrieves the geometry of the input volume, as specified in a .sat file or an .iges file.

Compute the enclosed volume - Computes and displays the enclosed volume of the input volume.

Compute the enclosed volume's centroid below a given height (fill-height is an example) - Computes and displays the centroid of the input volume.

Compute the overlap geometry between two adjacent Volumes - Retrieves the overlap geometry of two adjacent input volumes, as specified in a .sat file or an .iges file.

Compute the overlap geometry Area between two adjacent Volumes - Computes and displays the intersection type and intersection geometry of two adjacent input volumes.

Get the range of a Volume (along global CS) - Computes and displays range points of the input volume along the global coordinate system.

Get the minimum range of a Volume (optimal calculation) - Computes and displays the minimum range points of the input volume.

Get the minimum range of a Volume along Active CS - Computes and displays the minimum range points of the input volume along the global coordinate system.

Get the surfaces of the Volume geometry - Retrieves the geometry surfaces of the input volume, as specified in a .sat file or an .iges file.

Get Overlapping geometry for Volumes on a deck or plane - Retrieves the overlapping geometry between the input deck plate and the volumes on that plate, as specified in a .sat file or an .iges file.

Get Subtracted geometry for two objects - Retrieves the subtracted geometry of the two input volumes, as specified in a .sat file or an .iges file.

Retrieve an attribute on the selected Volume - Reports the attribute of the input volume.

Get Intersection Geometry of Volume and specific type Objects Overlapping Volume - Retrieves the intersection geometry for the input volume and the filter, as specified in a .sat file or an .iges file.

Custom Query

Computes and reports the objects, such as volumes or parts, according to the input.

Filter

Specifies a filter to control the results of the query. Click **More** to display the **Select Filter** dialog box.

Sl No.

Displays sequential numbers corresponding to the returned objects.

Results

Displays the object names.

Type

Displays the object type.

Select Filter Dialog Box

Creates, edits, deletes, and selects filters for use with the **Define Workspace**, **Surface Style Rules**, and other **Select by Filter** commands, including Project Management's **Model Data Reuse** (MDR), Drawings View Styles, and Reports commands that require runtime filter selection. You can access this dialog box in several ways.

- Select **File** > **Define Workspace**, and select the **More** option in the **Filter** box.

- Select **Format** > **Surface Style Rules**, click **New** or **Modify**, and then select the **More** option in the **Filter** box.

- Select **Tools** > **Select by Filter.**

The tree view displays the following types of filters:

- **Catalog Filters** - These filters are used to reference data in the Catalog. For example, a catalog filter could apply to company-wide operations. Your administrator can define Company_Filter_1, Company_Filter_2, and so forth.

- **Model Filters** - These filters are available to everyone assigned to a specific model database. There are delivered catalog filters to query on the different types of model objects. You must have the appropriate privileges to create, edit, or delete these filters.

- **My Filters** - These are personal filters that you create and place in the **My Filters** folder. They are visible only to you, the owner. You cannot see the personal filters of others, and they cannot see your personal filters. Select a filter from one of the listed filters, or create a new filter to meet your specific requirements.

New Folder

Creates a new folder.

New Filter (Simple or Asking)

Displays the **New Filter Properties** dialog box so that you can create a new filter. Asking filters allow you to specify the parameters of the search. An asking filter has built-in functionality to ask for values (with boxes that you are required to supply). The values apply to properties that you have already designated you will supply when the filter runs. Asking filters are portable between models.

NOTE Model Data Reuse (MDR) does not support asking filters. The only valid filter types for an MDR transaction are System, Permission Group, Object Type, Volume and Properties. You can define the filter on any one of these tabs or in a combination using multiple tabs.

New Compound Filter

Displays the **New Compound Filter Properties** dialog box, which you use to create a new compound filter containing the Or, And, or Not operators. Compound filters are not supported for MDR.

New SQL Filter

Displays the **New SQL Filter Properties** dialog box, in which you can type the text of an SQL query. SQL filters are not supported for MDR

Delete

Removes a filter or folder from the **Select Filter** list. If you delete a folder, the software also deletes its contents.

Rename

Changes the name of an existing filter or folder from the **Select Filter** list.

Properties

Displays the **Filter Properties** dialog box so that you can select the properties that determine your filter search criteria.

NOTES

- If this dialog box is activated from the **Select by Filter** command, you can select multiple filters on this dialog box. Hold CTRL or SHIFT, and click each filter. When you click **OK**, all objects that fit the selected filters are selected.

- If this dialog box is activated from the **Select by Filter** command, it clears the select set before adding objects to the select set.

S E C T I O N   1 0

Space Object Properties

After you have created space objects in the model, you can adjust the properties of the objects. The **Space Management** task provides you with the flexibility to make changes during the design process.

All objects in the **Space Management** task have properties that you can edit. Using **Select** on the vertical toolbar, you select the object that you want to edit.

An important part of the **Select** command is the **Locate Filter** box that appears on the ribbon. The **Locate Filter** box contains the available, pre-defined filters for the **Select** command. When you choose a filter in the **Locate Filter** box, the software allows you to select only the filtered objects in a graphic view or in the **Workspace Explorer**. For example, if you select **Interference Volumes**, you can select only interference volumes in a graphic view or in the **Workspace Explorer**.

The **Space Management** task includes these filters:

All Volumes

Allows you to select any space object in a graphic view or in the **Workspace Explorer**.

Area

Limits your selection in a graphic view or in the **Workspace Explorer** to space objects that are defined as areas.

Construction Graphics

Limits the selection of items to construction graphics.

Drawing Volume

Limits your selection in a graphic view or in the **Workspace Explorer** to space objects that are defined as drawing volumes.

Interference Volume

Limits your selection in a graphic view or in the **Workspace Explorer** to space objects that are defined as interference volumes.

Zone

Limits your selection in a graphic view or in the **Workspace Explorer** to space objects that are defined as zones.

All

Allows you to select any object, even objects created in another task.

⊞ Inside fence

> Selects all objects entirely inside the fence.

⊞ Inside/Overlapping fence

> Selects all objects entirely inside the fence and those objects outside of the fence but touching the fence at some point.
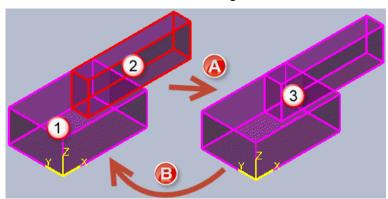
Editing Space Objects

Selecting a placed space object in your model automatically puts you in editing mode and displays the Edit Volume ribbon that you can use to perform basic editing functions, such as changing the name or space object type.

▤ NOTE After you create a drawing volume, you cannot change its type.

Using the **Properties** dialog boxes, you can adjust the occurrence properties of volumes not only during initial placement, but also afterwards. The **Edit Path** ribbons allow you to modify any and all necessary constraints for arcs, turns, or straight segments that are part of an existing path, either at placement or afterward.

If you modify the status or permission group of a merged space, the change is propagated to the sub-volumes, as shown in the following illustration:

In this example, volume 1 and volume 2 have a status of **Working** and belong to permission group XYZ. A merged volume 3 is created (arrow A) and then modified to have a status of **Approved** and assigned to permission group EFG. The **Approved** status and permission group EFG of volume 3 are propagated back to volumes 1 and 2 (arrow B).
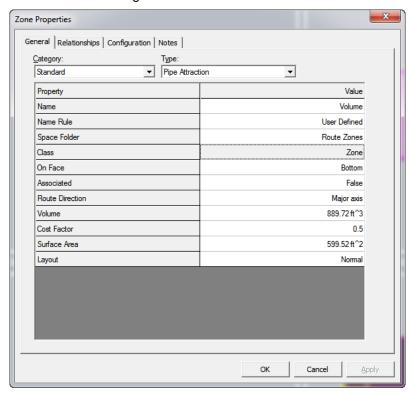
Similarly, if you change the status or permission group of a sub-volume, the change is propagated to other sub-volumes and the parent (merge or bound by space volume).

See Also
Edit Volume Properties (on page 72)
Place Volume Along Path (on page 41)

Properties Dialog Box

Sets options for the space objects that you create in the **Space Management** task. The dialog box title correlates to the type of space object that you select in the model. For example, if you select a zone and then display its properties, the title of the dialog box is **Zone Properties**, as shown in the following illustration:

Property	Value
Name	Volume
Name Rule	User Defined
Space Folder	Route Zones
Class	Zone
On Face	Bottom
Associated	False
Route Direction	Major axis
Volume	889.72 ft^3
Cost Factor	0.5
Surface Area	599.52 ft^2
Layout	Normal

General Tab (Volume Properties Dialog Box) (on page 94)
Shape Tab (Volume Properties Dialog Box) (on page 102)
Cross-Section Tab (Volume Properties Dialog Box) (on page 102)
Relationship Tab (on page 103)
Configuration Tab (on page 103)
Notes Tab (on page 104)

General Tab (Volume Properties Dialog Box)

Sets general options for the selected space object.

Standard

Type

Specifies the type of volume. Selecting **More** from the list opens the *Select System Dialog Box* (on page 20) from which you can select a volume type. The **Type** list is populated by the reference data and can be customized on a model-by-model basis. For more information on customizing space management reference data, see the *Space Management Reference Data Guide,* available from the **Help > Printable Guides** command.

★ **IMPORTANT** The data that displays in the **Properties** and **Values** columns is determined by what is selected in the **Type** list; however, all volume types have the following standard properties.

Name

Identifies the name property. The name can be either user-defined or generated by **Name Rule** conventions defined for the permission group.

Name Rule

Determines the naming rule used to designate the selected space object. If the status of a space object is set to **In Review**, this option cannot be edited.

Space Folder

Select the space folder in which to place the volume. You can create new folders using *Create Space Folder* (on page 12). Select **More** from the list to open the *Select Space Folder Dialog Box* (on page 13) from which you can select an existing folder that is not currently listed.

Class

Displays one of four volume classes - **Area**, **Zone**, **Interference Volume**, or **Drawing Volume**. This property is read-only.

★ **IMPORTANT** The following property only appears when you select **Interference Volume** in the **Type** list.

Volume

Displays the net volume of the selected Space Management volume. This property is read-only and is not displayed during object creation.

Surface Area

Displays the total surface area of the selected Space Management volume. This property is read-only and is not shown during object creation.

Display Aspect

Specifies the volume display aspect. The display aspect list is populated by what is defined in the reference data.
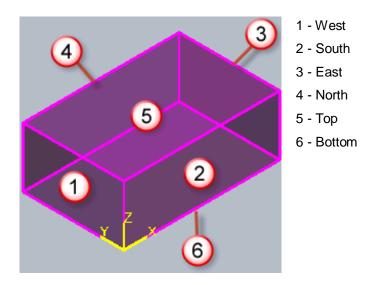
★ **IMPORTANT** The following Route Zones display additional **Standard** category properties specific to their zone type.

Pipe Attraction Zone

The Pipe Attraction Zone models a volume that attracts pipes. It has a cost factor, which means that routes that lie within the Pipe Attraction Zone are less expensive than equivalent routes outside the zone. The Pipe Attraction Zone is similar to the Pipe Rack Zone in that it modifies the result of the routing calculation by attracting pipes but has fewer rules for layout and for joining and leaving the zone. For more information, see *Pipe Attraction Zone Sheet* in the *Smart 3DSpace Management Reference Data Guide*. You can access this guide with the **Help > Printable Guides** command in the **Space Management** task.

On Face

Defines on which of the six faces the pipe is to be routed. Refer to the coordinate system triad of your volume when selecting the face.

1 - West

2 - South

3 - East

4 - North

5 - Top

6 - Bottom

In a Pipe Attraction Zone, the **On Face** property is not always obeyed if doing so will result in a change in the pipe routing. In other words, the software will not add bends to the route in order to force a pipe to run on the specified face. This behavior is in contrast to behavior of the **On Face** property in a Pipe Rack Zone. As such, Intergraph recommends that the **On Face** property always be defined for a Pipe Attraction Zone in order to avoid unpredictable behavior. If the property is left undefined, the zone will select any one of the four candidate faces as an appropriate default based on the **Route Direction** property. For example, if the **Route Direction** property is set to East, the software can choose Top, Bottom, North, or South faces as the default, whereas setting the **Route Direction** property to West can produce a different result.

Associated

Determines whether all pipes see the Pipe Attraction Zone as a candidate for routing, or only those pipes that explicitly reference the zone. If the value of the property is set to **True**, only those pipes with the Pipe Attraction Zone in their list of zones to use will do so. If the value of the property is set to **False**, all pipes will evaluate the Pipe Attraction Zone for use in routing.

Route Direction

Specifies the direction relative to the local coordinate system in which pipe will be routed. The **Route Direction** property defines the axis of the routed pipe, so an **East** value is the same as a **West** value, **North** is equal to **South**, and **Up** is equal to **Down**. It is unrelated to the direction of the pipe as it is routed between its From and To connections. For example, if a pipe is routed from West to East through a pipe attraction zone, the result is the same whether the **Route Direction** property is set to East or West. As pipes always run parallel to one of the pipe attraction zone axes, the route direction in a skewed or non-orthogonal rack is translated as the rack axis closest to the specified orthogonal axis. If a rack is at 45 degrees to orthogonal, the software uses the longer of the two candidate axes.

Cost Factor

Specifies the cost factor applied to pipe that runs through the Pipe Attraction Zone. Typically, the cost factor value is a number less than one. The lower the number, the more the zone attracts pipe.

Layout

Specifies how pipes are laid out.

- **Normal** - Pipe is laid out within the pipe zone. The pipe runs parallel to the **Route Direction** property and is on the face specified by the **On Face** property. The **Normal** layout is the default.

- **Surface** - Pipe is laid out on the outside surface of the zone. For example, this applies when modeling a floor or wall on which pipes run.

- **WayPoint** - A single pipe runs through the geometric center of the pipe zone. This mode is used to cause a pipe to run through a particular point in space.

Pipe Avoidance Zone

The Pipe Avoidance Zone models a volume that the pipe can enter if it is essential, but will avoid if possible. For example, it is not good practice for pipe to be placed within the immediate vicinity of a tank, but some of the pipes must connect to nozzles on the tank.

Cost Factor

Specifies the cost penalty applied to pipe that runs in the Pipe Avoidance Zone. Typically, the cost factor value is a number greater than one. The higher the number, the more the zone repels pipe.

Pipe Connection Zone

Pipe Connection Zones define a volume at which a route can terminate. They may act as obstruction zones (as defined by the **Obstruction** property) in addition to their special connection properties.

Connection Face

Specifies on which face the connection is made. The **End** and **Surface** values are intended for use with cylindrical connection zones, which support connection to the ends or the curved surface of a cylinder.
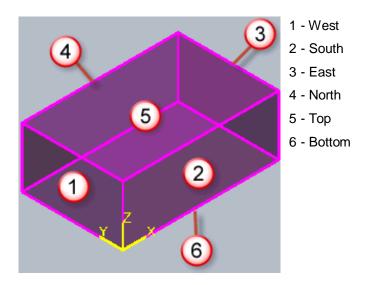
Obstruction

Specifies whether the zone allows pipes to be routed through it (value = **False**) or whether the zone allows pipes to be routed up to it, but not through it (value = **True**).

Pipe Rack Zone

On Face

Defines on which of the six faces the pipe is to be routed. Refer to the coordinate system triad of your volume when selecting the face.

1 - West

2 - South

3 - East

4 - North

5 - Top

6 - Bottom

Associated

Determines whether all pipes see the Pipe Rack Zone as a candidate for routing, or only those pipes that explicitly reference the zone. If the value is set to **True**, only those pipes with the Pipe Rack Zone in their list of zones to use will do so. If the value is set to **False**, all pipes will evaluate the zone for use in routing.

Route Direction

Specifies the direction relative to the local coordinate system in which pipe will be routed on a rack. The **Route Direction** property defines the axis of the routed pipe, so an **East** value is the same as a **West** value, **North** is equal to **South**, and **Up** is equal to **Down**. It is unrelated to the direction of the pipe, as it is routed between its From and To connections. For example, if a pipe is routed from West to East through a rack, the result is the same whether the **Route Direction** property is set to East or West. As pipes always run parallel to one of the rack axes, the route direction in a skewed or non-orthogonal rack is translated as the rack axis closest to the specified orthogonal axis. If a rack is at 45 degrees to orthogonal, the software uses the longer of the two candidate axes.

Layout

Specifies how pipes are laid out.

- **At Edge** - Pipes are laid out in joining order starting at each edge and working inwards.

- **Large Bore At Edge** - Pipes are laid out in bore order starting at each edge and working inwards.

- **Spreadout** - Pipes are laid out evenly across the rack.

- **At Center** - Pipes are laid out in joining order starting at the center of the rack and working outwards.

- **Large Bore At Center** - Pipes are laid out with the largest bore at the center and then working outwards.

- **Straight Through** - Pipes are laid out going straight through the rack. This option allows modeling of wall and floor penetrations.

Allowed Fluid Codes

Filters the pipes that can use the zone based on fluid type. Only the fluid types you specify are permitted on the rack. If more than one fluid type is to be allowed, use a comma or a space to separate them. For example, type **Process,Steam**.

Cost Factor

Displays the cost factor applied to pipe that runs on the rack. The software calculates this value based on data you specify for properties in the **Cost Estimation** category. Typically, the cost factor value is a number less than one. The lower the number, the more the zone attracts pipe.

Position and Orientation

East

Displays the distance along the East-axis (X-axis) from the origin of the active coordinate system to the origin of the local coordinate system on the volume.

North

Displays the distance along the North-axis (Y-axis) from the origin of the active coordinate system to the origin of the local coordinate system on the volume.

Elevation

Displays the distance along the Elevation-axis (Z-axis) from the origin of the active coordinate system to the origin of the local coordinate system on the volume.

Bearing

Displays the angle in the XY-plane between the volume's x-axis and the active coordinate system Y-axis (North). Another way to describe bearing is the rotation of the volume about its z-axis. The bearing direction moves clockwise from North, where North is 0 degrees. Bearing is also known as compass heading. The bearing value is always positive, with a range of 0 to 360 degrees.

Pitch

Displays the angle in the XZ-plane between the volume's x-axis and the active coordinate system's X-axis. Another way to describe pitch is the rotation of the volume about its y-axis. Pitch is limited to between -90 degrees and +90 degrees, with 0 as horizontal.

Roll

Displays the angle in the YZ-plane between the volume's z-axis and the active coordinate system's Z-axis. Another way to describe roll is the rotation of the volume about its x-axis. The roll is between 0 and 360 degrees and is measured clockwise if you are looking West.

★ **IMPORTANT** The following category only appears when you select **Pipe Rack Zone** or **Icarus Open Steel Zone** in the **Type** list.

Cost Estimation

Displays properties required by Aspen Icarus Process Evaluator™ to compute a cost that is based on Alias auto-routing.

📄 **NOTE** Aspen Icarus Process Evaluator is a third-party software product that allows process engineers to accurately evaluate the economic impact of their process designs.

Length

Specify the length.

Width

Specify the width.

Height

Specify the height.

Number of Stairways

Specify the number of stairways.

Grating Type

Specify the type of grating used in the zone.

Structural Steel Analysis

Specify the type of structural steel analysis.

Column Base End Condition

Specify the type of connection at the column base.

Distributed Load Per Level

Specify the distributed load per level.

Wind Force Adjustment

Specify the adjustment for wind force.

Seismic Force Adjustment

Specify the adjustment for seismic force.

⭐ **IMPORTANT** The following **Cost Estimation** properties are only available when you select **Pipe Rack Zone** in the **Type** list.

Pipe Rack Type

Specify the type of pipe rack.

Concrete Type

Specify the type of concrete.

Number of Levels

Specify the number of levels.

Height First Level

Specify the height of the first level. The default measurement is in feet and inches.

Number of Ladders

Specify the number of ladders.

Number of Braced Bays

Specify the number of braced bays.

Number of Beam Struts Per Pipe Level

Specify the number of beam struts on each pipe level.

Number Catwalks

Specify the number of catwalks.

Catwalk Width

Specify the required width of the catwalk.

Main Bent Spacing

Specify the main bent spacing.

Third Column Option

Specify whether or not a third column is necessary. For a two-bay rack, a third column is required.

Air Cooler Loading

Specify the maximum load for the air cooler.

Number of Beam Struts Per Column Line

Specify the number of beam struts for each column line.

End Bent Exclusion

Specify whether or not to excluded end bents in the zone.

Minimum Beam Or Column Width

Specify the minimum width of the beam or column.

★ **IMPORTANT** The following **Cost Estimation** properties are only available when you select **Icarus Open Steel Zone** in the **Type** list.

Number of Floors

Specify the number of floors.

Bay Span

Specify the span of the bay.

Bay Width

Specify the width of the bay.

Floor Grate Percent Area

Specify the percent of the area through which you can route pipe.

Siding Percent Area

Specify the percent of the area through which you can route pipe.

Floor Slab Percent Area

Specify the percent of the area through which you can route pipe.

Slab Thickness

Specify the thickness of the slab.

Shape Tab (Volume Properties Dialog Box)

Displays information about the primitive shape used as the basis for placing a space object. This tab is only available for space objects created with **Place Volume Using Primitive Shapes** 🖨. You can view an image of the selected shape at the bottom of the dialog box.

Standard

Shape

Specifies the shape. The list of available shapes is defined in the Equipment and Furnishings reference data for designed equipment.

Property/Value Grid

Displays dimensional information for the currently selected shape. In the space below the grid, you can view an image of the shape.

Cross-Section Tab (Volume Properties Dialog Box)

Displays information about the cross-section for a volume that was projected along a path. This tab is only available for volumes created with **Place Volume Along Path** ▱.

Standard

Cross-Section
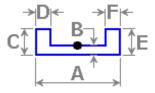
Specifies the type of cross-section for the volume. You can either select a standard cross-section defined in the reference data or select **Sketch** to draw your own cross-section.

When a standard cross-sectional type is selected in the **Cross-Section** list, you can modify the properties that are described later in this topic. When **Sketch** is selected in the **Cross-Section** list, you can view each point, its coordinates, and its turn type in the table at the bottom of the tab, but you cannot modify the data. For more information, see *General Tab (Sketch Properties Dialog Box)* (on page 107).

⌗ Display Cross-Section Image

Displays the image associated with the standard cross-sectional type in the reference data.

Cross-sectional images show the dimensions for the cross- sectional type, the default cardinal points for the cross-sectional type, and the angle for the cross-section. This graphic contains the dimensions and cardinal point for an example cross-section.

A - G

Defines the dimensions for standard cross-sections. If an image is defined for the cross-section in the reference data, you can see what each letter represents by clicking **Display Cross-Section Image** ⌗.

Cardinality

Defines the point at which you want the software to attach the cross-section to the path. If you click **Display Cross-Section Image** ⬚ to see a picture of the cross-section, you can view where each cardinal point is located. The software automatically updates the display in the model when you select a different cardinal point.

Rotation Angle

Defines the angle by which the cross-section is rotated about the path.

Relationship Tab

Displays all objects related to the selected object for which you are viewing properties. For example, if you are viewing the properties of a pipe run, the related pipeline, features, parts, associated control points, hangers or supports, and equipment display on this tab. All WBS assignments, including project relationships, appear on this tab.

Additional examples for marine relationships are as follows:

- For plate and profile system properties, the related bounded objects, bounding objects, and connections are shown.

- For plate and profile system part properties, parent systems are shown.

- For assembly connection properties, all connected objects are shown.

- For the properties of a frame connection on a member, supported, supporting, and auxiliary supporting parts are shown.

- For split connection properties, the parent and auxiliary supporting parts are shown.

Name

Specifies the name of the object.

Type

Specifies the type of object. To change the options on the list, edit the **Weld Type** select list in Catalog.

Go To

Displays the properties of the selected object.

Configuration Tab

Displays the creation, modification, and status information about an object.

📄 **NOTE** You cannot define the filters using the **Configuration** tab.

Plant

Displays the name of the model. You cannot change this value.

Permission Group

Specifies the permission group to which the object belongs. You can select another permission group, if needed. Permission groups are created in Project Management.

Transfer

Reassigns ownership of the selected model objects from their current permission group to

another satellite or host permission group. This option is only available if the active model or project is replicated in a workshare configuration. The option is not available if all of the objects in the select set already belong to another location and are non-transferable. For more information, see *Transfer Ownership Dialog Box* in the *Common User's Guide*.

NOTE The **Transfer** option does not apply to the filters and surface style rules.

Approval State

Specifies the current status of the selected object or filter. The display depends on your access level. You might be unable to change the status of the object. The list is defined by the ApprovalStatus codelist.

NOTE You can only edit or manipulate an object with a status of **Working**.

Status

Specifies the location of the object in the workflow process. Changing this property sets the **Approval State**. The list is controlled by the ApprovalReason codelist in the ApprovalReason.xls file. You must bulkload this file. For more information, see *ApprovalReason* in the *Reference Data Guide*.

Date Created

Specifies the creation date of the object.

Created by

Specifies the name of the person who created the object.

Date Last Modified

Specifies the date when the object was last modified.

Last Modified by

Specifies the name of the person who last modified the object.

Notes Tab

Creates and edits user-definable text placed by the designer on an object in the model. The notes provide special instructions related to the object for the fabricator and are available in downstream tasks. For example, the notes appear in two-dimensional drawings and within design review sessions.

NOTE Only one note of a given kind from a given object can be shown on a drawing. For example, if there are two fabrication notes on a piping part, then only one of the notes shows on the drawing. It is important to know about and to consider this situation when defining notes on an object in the modeling phase. For example, you can display one Fabrication note and one Installation note by defining two separate labels for the two kinds of notes.

Key point

Specifies the key point on the object to which you want to add a note.

Notes at this location, listed by name

Lists all notes for the selected key point on the object.

Date

Displays the date that the note was created. The system automatically supplies the date.

Time

Displays the time that the note was created. The system automatically supplies the time.

Purpose of note

Specifies the purpose of the note.

Author

Displays the login name of the person who created the note. The system automatically supplies this information. You cannot change this information.

Note text

Defines the note text. The software does not limit the length of the note text.

Show dimension

Indicates that the note generates a dimension.

If you are displaying the properties for a Support component, then a dimension can be included for the component in the Support drawings, if you select the **Show dimension** option. The note must be associated with one of the key points for the Support component. It is recommended that you set the **Purpose of note** as **Fabrication**, but this is not a requirement. The note **Name** and **Note text** are not used when you select this option.

New Note

Creates a new note on the object.

Standard Note

Displays a list of standard notes from which you can select. This feature is not available in this version.

Highlight Note

Highlights the note in the graphic view so that you can easily find the note and the object to which it is related. This feature is not available in this version.

Delete Note

Deletes the currently displayed note.

Space Folder Properties Dialog Box

Sets options for a space folder.

General Tab (Space Folder Properties Dialog Box)

Sets general options for the selected space folder.

Standard

Name

Displays the name assigned by rule to the volume. You can type a different name.

Space Folder

Specifies the parent to which the selected space belongs. The parent determines the placement of the folder within the space hierarchy. Selecting **More** in the list displays the *Select Space Folder Dialog Box* (on page 13).

Drawing Volume Properties Dialog Box

Sets options for a volume associated with a drawing volume component.

General Tab (Drawing Volume Properties Dialog Box) (on page 106)
Relationship Tab (on page 103)
Configuration Tab (on page 103)
Notes Tab (on page 104)

General Tab (Drawing Volume Properties Dialog Box)

Displays and defines the general properties for a selected drawing volume.

Category

Select the properties that you want to see. You can view system properties or custom-defined properties.

Name

Specifies the name of the volume. You can type a different name.

Name Rule

Specifies the rule for the name. If you type a new name in the **Name** box, this box displays **User Defined**.

Drawing Type

Displays the drawing volume component. The component is associated with a template, which contains drawing views.

Drawing View

Displays the name of the view that is populated with objects in the volume.

Type

Displays the type of volume, such as **Drawing Volume**.

📝 NOTE After you create a drawing volume, you cannot change its type.

Sketch Properties Dialog Box

Sets options for paths. You cannot edit the properties on this dialog box. For more information, see *General Tab (Sketch Properties Dialog Box)* (on page 107).

General Tab (Sketch Properties Dialog Box)

Displays the points that make up a path, their coordinates, turn types, and turn type dimensions.

Point No

Displays the point number that identifies the selected point.

X

Displays the location of the point on the X-axis.

Y

Displays the location of the point on the Y-axis.

Z

Displays the location of the point on the Z-axis.

Turn Type

Displays the type of turn associated with the point. Turn types include none, bend, chamfer, and cornice.

Value

Specifies dimensions for the selected turn type. For bends and cornices, the value specifies the radius of the bend. For chamfers, the value specifies the dimensions for setback A and setback B of the chamfer.

See Also

Properties Dialog Box (on page 94)
Place Volume Along Path (on page 41)

Glossary

abstract part

A part that is only defined by a partial specification and that cannot be materially provided by the organization that defines the specification.

Active Template Library (ATL)

Set of class templates and wizards supplied with Microsoft C++ Version 5.0 and later. You can use an ATL when you create ActiveX controls and any other type of object that uses the Component Object Model (COM) model. Using an ATL is generally preferred over Microsoft Foundation Classes (MFC), because the implementations are smaller, easier to use, and more closely tied to the COM model.

angle

The circular measurement taken from the intersection of two pipes at a turn or branch.

approval state

Recorded state of acceptance of information contained in objects within the database. The approval states indicate a level of confidence in the information stored in the database and govern your ability to alter specific data about a product.

arrangement (accommodation)

Those components of a system arranged in three-dimensional space with accurate dimensional representation for installation. Various types include electrical, HVAC, machinery, outfitting, and piping.

attribute

A single type of non-graphics information that is stored about an object such as diameter or end preparation.

axis

An imaginary line used to define the orientation of a system or object normally defined in terms of an x-, y-, and z-axis. Some 3-D graphic objects have an associated axis used to define the center or axis for rotations.

basic design

Engineering definition of the model and its systems.

bill of material (BOM)

Hierarchical decomposition of a product into constituent assemblies and parts. Specific types of BOMs exist (for example, an EBOM is a bill of material from the point of view of an engineering department; an MBOM is a bill of material from the point of view of manufacturing).

block division

Process of establishing boundaries of the major units or blocks to use in building a plant.

bulkload

The process by which reference data in Microsoft Excel workbooks is loaded into the Catalog database.

catalog

Repository of information about components and materials used in construction. When you use catalog parts in the model, the software places an occurrence of the catalog part in the project. This occurrence is a copy of the actual catalog part.

Catalog database

The database that contains the reference data. Each model database can reference a different Catalog database.

chain

A set of continuous and tangent segments.

change history

Process of recording information such as who, when, and why for any given modification.

change management

Software features or manual procedures for managing the consequence of change. For example, software can support a change management feature to report drawings that need updating as a result of a change in a 3-D model.

change propagation

Ability of the software to intelligently modify dependent design information to reflect change in a higher order object.

class

Grouping of individual objects that share some very significant, common characteristics.

classification folder

A folder in the Catalog hierarchy that contains part classes. Classification folders are one level above part classes. The ClassNodeType and R-ClassNodeDescribes sheets in the Microsoft Excel workbooks define the classification folders.

codelist

A set of acceptable values for a particular property that can be referred to by an index number or selected in a combo box. For example, the codelist for the material specification allows you to select from a set of standard entries, such as ASTM A183-F316 Stainless Steel.

commodity code

A user-defined code that provides an index to parts in a catalog.

commodity item

A standard component found in a manufacturer catalog (an off-the-shelf component).

component

Physical part that a feature generates.

concurrent access

Ability of the software to allow multiple users to simultaneously access and modify the design of a model.

consolidated tasks

A collection of tasks run in batch. For example, the software allows you to extract a set of drawings immediately or to schedule the batch extraction for a future time.

constraints

A logical restriction that controls how part symbols ports relate to each other and to reference ports. There are four constraints: parallel, perpendicular, coincident, and distance.

contract

A Work Breakdown Structure object representing a scope of work, usually performed by an external supplier. The contract is related to a project and appears in the Work Breakdown Structure hierarchy.

coordinate

The location of a point along the X-, Y-, or Z-axis.

coordinate system

A geometric relation used to denote the location of points in the model. The most common coordinate system is the rectangular coordinate system, whereby points are located by traversing the X-, Y-, and Z-axes of the model. Normally, coordinate systems have their origin defined as 0,0,0.

cutting plane

A plane that cuts through an object.

damage records

Data relating to the damage and repair of structure or components that occurred during or after construction of a plant.

data interchange

Capability to output the design, or portions of the design, in a standard format for use or movement to another computer software system.

database

Repository for the product model data. The database contains information to describe individual objects in the data model and the relationships between objects as appropriate.

database backup

Process of recording a backup copy of the complete database or the incremental changes after the date that the last complete copy was created.

database break and recovery

Utilities used to restore a database after files are corrupted.

database copy

Functionality to copy large collections of model objects from one design project to another design project.

database management

Functionality related to managing a product model database.

database monitor record

Transactions that occur in order to provide database (DB) recovery after a stop in response with a minimum of lost data.

degree

The highest polynomial factor in the curve or surface mathematical definition. A line is a degree 1 curve, while a cubic B-spline is a degree 3 curve.

design alternative

Difference in a design represented by a separate version. A design alternative can be a new design prepared as a proposed change, or one of several elective options that the builder or customer selects. Each design alternative has an identification assigned so you can uniquely refer to the design alternatives.

design approval log

Record of review and approval of parts of the design.

design data auto input

Automation in loading existing design data into a new design database.

design documents

Drawings, sketches, material lists, procedures, and so forth that are generated during the design phase.

design object

Any object with properties that you can select. A design object can be related to one or more contracts of different types, but related only to one contract of a given type.

design progress check

Analysis of the content of the design to some metric unit that gives an idea of the degree of completion.

design review

Functionality to support rapid viewing of the design and markup of features with comments.

design service

Any general system services related to the design function.

design standard

Feature or object used in plant design that has been determined to the normal or approved way of accomplishing a design requirement. In the context of computer software, the term refers to computer functionality to support standards, not the standard itself.

detail schedule

Lowest level of schedule used to manage and track work progress.

distributed systems

Systems consisting of sequential parts with a distributive characteristic (for example, pipes distribute fluids, HVAC distributes air, cabling distributes power, and structure distributes loads).

distribution systems

Term synonymous and used interchangeably with the term distributed systems.

documentation

Drawings and other records that you must produce to document, obtain approval, or build the design.

drawing tool

Tool that helps in the process of creating, modifying, or manipulating objects. Examples are PinPoint and SmartSketch.

easting

A term that describes an east coordinate location in a coordinate system.

edge

A topological object that represents a trimmed curve bounded by a start and end vertex.

edge distance

The distance from the center of a bolt or rivet to the edge of a plate or flange.

equipment catalog

Catalog of equipment geometry and limited properties that the software uses to identify and visualize equipment and its placement in the model. The catalog is not the source for the total specification and ordering data for the object.

fabricate

To cut, punch, and sub-assemble members in the shop.

face-to-face

The overall length of a component from the inlet face to the outlet face.

fasteners

Bolts and rivets used to connect structural members.

element

Primitive geometric shape such as a line, circle, or arc.

fence

Boundary or barrier that separates or closes off an area. To surround or close like a fence.

field adjustment

Material added to the neat design geometry of piping or structural parts to allow for fit up in the case that extra material is required due to uncontrolled variance in the manufacturing and construction process.

flavor

A different variation of a symbol. Each variation has different occurrence property values.

focus of rotation

A point or line about which an object or view turns.

full penetration weld

A type of weld in which the weld material extends through the complete thickness of the components being joined.

function points

Part of the requirements documentation, function points are the smallest granularity of a requirement statement that describe specific detailed actions that the software performs.

functional block diagram

Schematic representation of a system (piping, electrical, ventilation) showing system parts and their relationship. You use symbols to represent equipment and components. A connecting network of lines illustrates their relationship. Taken together, the symbols and the network illustrate the function of the system.

furnishings

Parts such as movable articles and fittings that normally are not associated with a system (for example, a chair).

generic specific

Object that is parametrically defined or defined to suit a family of specific parts (for example, International Standards parametrics). For example, a 100 - 200 gpm pump in the catalog can provide a general shape to appear in the model until a specific object has been identified. See also specific and specific object.

GUIDs

Acronym that stands for Globally Unique Identifiers. The software automatically creates the GUIDs sheet in the Excel workbooks when you create the Catalog database and schema. The purpose of storing GUIDs within Excel workbooks is to help you keep track of what has been loaded into the database. Storing GUIDs also helps to avoid the situation in which a replacement Catalog database causes existing models to become invalid.

host location

The first location created for a Site. This host location is defined when the Database Wizard creates the Site database.

host server

The database server on which the Site database was created using the Database Wizard. Alternatively, if it is a restored database set, the Host Server is the database server where the Site database is restored. The Host Server in a Workshare environment contains the origin for the Site, Site Schema, Catalog, and Catalog Schema databases. Consequently, most Project Management and reference data work must take place at the Host.

initial design

Early stage of design work, generally before contract, used to estimate construction costs and provide a rough concept of the intended plant. Contains information relating to a plant created during its initial (concept) design period.

initial structural plan

Principal structural plan for the plant; also called a construction profile.

instantiation

Occurrence of a catalog object at a specific geometric location in the model.

interference checking

A process that identifies possible collisions or insufficient clearance between objects in the model.

job order

Industrial authorization for accomplishing work; synonymous with a work order.

kinematics analysis

Analysis of mechanical motion.

ksi

Kips per square inch.

leg length analysis

Preferred term is welding length analysis.

library

Resource of reference information that you can access in developing a plant design.

life cycle database

Information developed to assist in the maintenance and modernization of delivered plants.

link

Way to store information about another file in your document. You can update a link so that changes in the file appear in your document.

lintel

A horizontal member used to carry a wall over an opening.

load group

A grouping in which all components feature uniform load limits and stress safety characteristics. For example, if a pipe clamp from load group 5 has a maximum nominal load of 20kN, then so does a threaded rod from load group 5.

location

A Location is defined by three user-defined inputs: 1) a unique name, 2) a unique name rule ID, and 3) the server where the Site databases reside for that Location. A Location is defined and created when the Site database is created using the Database Wizard. Additional Locations can be created in the Project Management task. Each Location is a Site-level object, thus other Plants within the same Site collection can use the Locations when the Plants are configured for Workshare.

logical member

An object in the model used to represent the design topology.

machinery

Major pieces of equipment installed in a plant.

macro

A sequence of actions or commands that can be named and stored. When you run the macro, the software performs the actions or runs the commands. You can create the macros in Visual Basic or other OLE-aware programming applications. Some of the other OLE-aware programming applications are Visual Basic for Applications, Visual C++, and so forth.

maintenance envelope

A rectangular box around the part for clearance during maintenance operations.

maintenance records

Records of breakdown, repair, and overhaul of equipment.

material analysis

Analysis of a completed design work for extracting detailed material requirements; also called material lists.

material list

An option category that controls the format and content of the bill of materials.

methods

Objects in the database that describe the manufacturing methods to the component parts of a plant.

move from point

Starting point for an action. For example, when you move an equipment object, the Move From point determines the point of origin for the move.

move to point

Ending point for an action. For example, when you move an equipment object, the Move To point determines where you want the move to stop.

MTO neutral file

A non-graphic output file that can be fed into a material control system. MTO stands for Material Take-Off.

node

- One of the set of discrete points in a flow graph.

- A terminal of any branch of a network or a terminal common to two or more branches of a network.

- An end point of any branch or a network or graph, or a junction common to two or more branches.

northing

A term that describes a north coordinate location in a coordinate system.

nozzle

A piping connection point to a piece of equipment.

nozzle standout

The shortest allowable distance between the connection point of a nozzle and the start point of a turn on the leg connected to the nozzle.

NPD (Nominal Piping Diameter)

The diameter of a pipe.

object

A type of data other than the native graphic format of the application.

occurrence (of part or equipment)

Instantiation of a part of equipment in the model that refers to the part library; an instance of a specific object. The design can be built several times, and therefore the occurrence can apply to more than one hull. Typically, an occurrence points back to a specific object, either for its complete definition, as in the case of a particular valve, or for its made from material, as in the case of a steel plate part cut from sheets. Thus, when a designer selects a component from the catalog and places it at a location in the space of the plant, the software creates an occurrence of that object in the plant design.

occurrence property

A characteristic that applies to an individual object in the model. Occurrence properties are designated with 'oa:' in the reference data workbooks. You can view and modify occurrence properties on the Occurrence tab of the properties dialog boxes in the software. Depending on the object, some occurrence properties are read-only.

origin

In coordinate geometry, the point where the X-, Y-, and Z-axes intersect.

origin point

The point at which the coordinate system is placed, providing a full Cartesian coordinate system with positive and negative quadrants. Points are placed at coordinates relative to the origin point, represented by the X, Y, and Z values.

orthogonal

The characteristic of an element consisting completely of elements positioned at 90-degree angles. A square is an orthogonal element.

orthographic

A depiction of an object created by projecting its features onto a plane along lines perpendicular to the plane.

P&ID

Diagram that shows the topology, functional components, and special requirements of a piping system; generally represents the engineering design of the system.

package

Set of closely related classes. (UML)

painting

Computation of paint surface and recording of paint system requirements.

parameter

A property whose value determines the characteristics or behavior of something.

part class

A group of similar objects. You can define part classes in the Excel workbooks. A part class can have multiple parts. For example, a heat exchanger part class can contain heat exchangers with different dimensions.

part number

Unique identifier of a part.

PDS (Plant Design System)

A comprehensive, intelligent, computer-aided design and engineering application for the process, power, and marine industries. PDS consists of integrated 2-D and 3-D modules that correspond to engineering tasks in the design workflow.

PinPoint

Tool that allows you to place, move, and modify elements with precision, relative to a reference point.

principle of superposition

The principle that states that the stresses, strains, and displacements due to different forces can be combined. This principle is only valid for linear analysis.

Product Data Management (PDM) System

Software intended to manage both product data and documents associated to the product data. Functionality typically includes: object-based data modeling tools, user administration, business rules, and document management. Document management typically includes document editing or reviewing, document mark-up or redline, document storage, and full-text retrieval.

product structure

Hierarchical breakdown or decomposition of a product into constituent parts, volumes, or units. (For example, a bill of material is one possible type of product structure.)

production planning

Functionality associated with the work breakdown and sequence of the construction of a plant.

promotion

Process of associating approval state with a product version. A product version begins its existence at a working approval state. When the version is at some level of maturity, its approval state is elevated to a higher approval state (that is, promoted). Then, further changes must be carefully controlled and generally require the data set demoted to a working state. One or more promotions can occur successively higher approval states (between working and approved) to represent various intermediate levels of review or progressive approval.

query select sets

Set of objects that are selected in a query or queries on the database.

reference data

The data that is necessary to design plants or ships using the software. Reference data includes graphical information, such as symbols. It also contains tabular information, such as physical dimensions and piping specifications.

resource estimation

Rough estimate of material, manpower, and facility utilization for the design and construction of the plant.

route

1) A line connecting a series of points in space and constituting a proposed or traveled route. 2) The set of links and junctions joined in series to establish a connection.

satellite server

The database server where the replicated databases reside for Workshare. The Satellite Server is not used unless Workshare is activated.

schema

A database that creates the structure of another database. For example, a schema specifies the queries, tables, fields, and data types in a database.

schema update utility

Functionality used to assist in processing existing product models to an updated database structure after you modify or add to the database structure.

site

The top level in the Project Management hierarchy. A Site configuration may contain several Catalogs, each shared by multiple Plants.

site administrator

Person responsible for managing the standards and general parameters for a given plant site within a Site database.

site setup

Functionality associated with establishing a new plant site or hull for design development.

sketch and trace

User interface for rough definition of a required design feature that typically works in a 2-D mode.

specifications

Contracted requirements for the plant.

stud

A bolt, threaded on both ends, used to connect components.

suspended floor

A concrete floor system built above and off the ground.

symmetric node

Type of vertex on a curve. A curve with a symmetric node has the same curvature on each side of the node. A handle can be attached to a symmetric node for editing.

system

A conceptual design grouping that organizes parts in hierarchical relationships. A system represents a functional view of the model and includes information such as system name, type, properties, and design specifications for the objects assigned to the system.

tag number

User-specific, unique number assigned to an object (for example, CV-101 for a control valve, HE-2002 for a heat exchanger).

target point

The origin for coordinate measurements displayed by PinPoint. You can position the target point anywhere on the drawing sheet or view.

tolerant geometry

A type of ACIS geometry - either an edge or a vertex - that is outside the tolerance for ACIS and requires special handling.

trimmed surface

A surface whose boundary is fully or partially inside the "natural" geometric definition of the surface. Some or the entire control polygon extends outside the face boundary.

trunk

Feature that quickly reserves space for the distributive systems and other systems that have a path. Along the trunk are stations that define the cross section and identify part or system membership.

unit/module modeler

Facility of the system to structure collections of equipment and components into a single identifiable object.

user attributes

A customized property in the reference data. The Custom Interfaces sheets in the Excel workbooks define these properties. You can list the customized properties on the individual part class sheets.

version control

Ability of the system to manage multiple versions of a single part of the design. Version control should support conditional analysis and promotion status, as well as alternate design features among hulls within a plant site.

vertex

A topological object that represents a point in the three-dimensional model.

viewset

Set of objects (usually a subset of the entire database) that a view operation uses. Membership or lack of membership for any object in a viewset does not affect the actual stored representation of the object, but only its availability or desirability for viewing in the current scenario.

weight and CG analysis

Routines that compute the weight of commodity materials as configured in a given design (for example, plate and pipe) and determine total weight and center of gravity (CG) for a collection of material and equipment, as well as the complete plant.

welding

Weld requirements for joining materials. Welding length analysis is the calculation of required weld dimensions; also called leg length analysis.

wirebody

A topological object that represents a collection of edges jointed at their common endpoints.

wizard

Software routine attached to an application that provides guidance and expert help to you to complete one of the functionalities of the application.

work content

Estimation development of metrics from the database that relates to the work hour content of the various construction units.

work order

Plant authorization for completing work; synonymous with a job order.

working plane

The available 2-D plane of movement for endpoint selection.

workset

Set of objects (usually a subset of the entire database) used in an interactive change, add, or delete operation. Membership or lack of membership for any object in a workset does not necessarily affect the actual stored representation of an object. However, you can change or delete an object in a workset that also results in a change or deletion of the stored object. Similarly, when you add a new object (not currently stored) to a workset, the software also adds the object container.

workspace

Area that represents the portion of the model data needed to perform the intended task and includes the user modeling settings.

workspace document

Document into which you can extract a portion of the model data for a user task.

Workspace Explorer

Tree or list representation of objects in your workspace.

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